J Bequaert

PSYCHE

A JOURNAL OF ENTOMOLOGY

ESTABLISHED IN 1874

VOL. 54 JUNE, 1947 No. 2

CAMBRIDGE ENTOMOLOGICAL CLUB
1874

TABLE OF CONTENTS

Early Insect Life. *F. M. Carpenter* 65

A List of Spiders from Mona Island, with Descriptions of New and Little Known Species. *E. B. Bryant* 86

Taxonomic Notes on the Dilaridae (Neuroptera). *F. M. Carpenter* 100

On Some Acarina from North Carolina. *N. Banks* 110

Trichopria tabanivora Fouts in Massachusetts (Hymenoptera, Diapriidae). *N. S. Bailey* 142

Book Notice—Hubbard's *Fleas of Western North America* 143

CAMBRIDGE ENTOMOLOGICAL CLUB

OFFICERS FOR 1946–47

President	P. J. DARLINGTON, JR.
Vice President	J. BEQUAERT
Secretary	N. S. BAILEY
Treasurer	F. M. CARPENTER
Executive Committee	N. BANKS C. T. BRUES F. M. CARPENTER

EDITORIAL BOARD OF PSYCHE

C. T. BRUES—EDITOR-IN-CHIEF
F. M. CARPENTER—ASSOCIATE EDITOR
P. J. DARLINGTON, JR.
J. BEQUAERT

PSYCHE is published quarterly, the issues appearing in March, June, September, and December. Subscription price, per year, payable in advance: $3.00 to Subscribers in the United States; Canadian and foreign subscriptions $3.25, payable at par. Single copies, 85 cents.

Cheques and remittances should be addressed to Treasurer, Cambridge Entomological Club, Biological Laboratories, Harvard University, Cambridge, Mass.

Orders for back volumes, missing numbers, notices of change of address, etc., should be sent to Professor F. M. Carpenter, Biological Laboratories, Harvard University, Cambridge, Mass.

IMPORTANT NOTICE TO CONTRIBUTORS

Manuscripts intended for publication, books intended for review, and other editorial matter, should be addressed to Professor C. T. Brues, Biological Laboratories, Harvard University, Cambridge, Mass.

Authors contributing articles over 8 printed pages in length will be required to bear a part of the extra expense, for additional pages. This expense will be that of typesetting only, which is about $2.00 per page. The actual cost of preparing cuts for all illustrations must be borne by contributors; the expense for full page plates from line drawings is approximately $5.00 each, and for full page half-tones, $7.50 each; smaller sizes in proportion.

AUTHOR'S SEPARATES

Reprints of articles may be secured by authors, if they are ordered before, or at the time proofs are received for corrections. The cost of these will be furnished by the Editor on application.

The March, 1947, PSYCHE (Vol. 54, No. 1) was mailed April 4, 1947.

THE SCIENCE PRESS PRINTING COMPANY, LANCASTER, PA.

PSYCHE

Vol. 54 June, 1947 No. 2

EARLY INSECT LIFE*

By Frank M. Carpenter
Harvard University

Most entomologists, whether concerned with insect control or taxonomy, are convinced that we have enough living insects to contend with, without bothering about those of prehistoric times. Paradoxical as it may be, however, man apparently owes his very existence to the early insects. Some three hundred million years ago, as the first Amphibia abandoned the aquatic environment of their ancestors and explored the possibilities of terrestrial life, they were obliged to find a new source of food. By that time, the insects had already become established on land and, being especially abundant near water, were readily available to them. The amphibians were thus able to survive in their new environment and eventually their descendants gave rise to reptiles, birds and mammals. Many geologic periods later—only a few million years ago, in fact—man evolved within the mammalian complex. Cannot the insects claim, therefore, that if it were not for their early ancestors, the vertebrates might have failed to gain a foot-hold on land and man might not have come into existence?

Let us consider the nature and extent of the early insect life to which we presumably owe so much. "Early" is of course a relative term, and to define my present use of it, I must refer to the conventional geologic timetable. Figure 1 lists the eras and periods of that part of geologic time with which paleontology is chiefly concerned. Of the three eras, the Paleozoic is the earliest and longest, beginning about 550 million years ago and extending up to some 190 million years ago. For convenience, it is divided into six periods of unequal duration, their limits being arbitrarily set with reference to extensive geologic events. In this account of early insect life, I am referring only to the insects of the Paleozoic era—from the first appearance of the group through the Permian Period.

---

* Annual Public Address of the Entomological Society of America, Richmond, Virginia, December 9, 1946. Published with the aid of a grant from the Museum of Comparative Zoölogy at Harvard College.

The question of the oldest geologic occurrence of any group of organisms is always a controversial one, for much depends on interpretation of fragmentary material and the definition of the group. Handlirsch showed in 1906 that the fossils described as insects from strata *older* than those of the Upper Carboniferous Period were not insects at all; and he concluded that the earliest record of the class was in the lower part of that period. During the past forty years discovery of three older insects has been announced. Two of these, identified as Collembola, have been described from Devonian rocks, the Rhynie Chert, of Scotland.[1] Without going into details, we can

TABLE OF GEOLOGIC PERIODS

ERA	PERIOD		APPROXIMATE TIME (IN MILLIONS OF YEARS)	
			DURATION OF PERIOD	SINCE BEGINNING OF PERIOD
CENOZOIC (AGE OF MAMMALS AND MAN)	QUATERNARY		1	1
	TERTIARY		69	70
MESOZOIC (AGE OF REPTILES)	CRETACEOUS		50	120
	JURASSIC		35	155
	TRIASSIC		35	190
PALEOZOIC (AGE OF INVERTEBRATES AND PRIMITIVE VERTEBRATES)	PERMIAN		25	215
	CARBONIFEROUS	UPPER	35	250
		LOWER	50	300
	DEVONIAN		50	350
	SILURIAN		40	390
	ORDOVICIAN		90	480
	CAMBRIAN		70	550

Figure 1. Table of Geologic Periods. (Adapted from Romer's *Vertebrate Paleontology,* University of Chicago Press.)

---

[1] R. J. Tillyard, Trans. Ent. Soc. London, 1928: 65–71; H. Womersley, Victorian Naturalist, 1934, vol. 51: 159–165; D. J. Scourfield, Proc. Linn. Soc. London, 152 sess., 1939–40: 113–131.

state that these fossils are very fragmentary, the largest specimen being only about a millimeter long. Many parts of the head and thorax have been found, but since only the first three abdominal segments are known, there is no evidence that the collembolan ''spring'' was present, or that the abdomen consisted of but six segments, as in living Collembola. Consequently, although such eminent authorities as G. H. Carpenter and H. Womersley have accepted the specimens as Collembola, I believe that doubt about their relationship will exist until additional fossils have been found showing those two characteristic features of the Collembola. As a matter of fact, as Imms and others have pointed out, the Collembola are not true insects—that is, although hexapodous arthropods, they arose independently from pre-insectan types. The possible occurrence of Collembola in Devonian rocks, therefore, has no direct bearing on the earliest record of true insects.

The other discovery of an insect in rocks older than the Upper Carboniferous was announced by the French paleontologist, Dr. Pierre Pruvost, in 1919. The specimen concerned was found in Lower Carboniferous strata of Nova Scotia (Horton's Bluff), and identified by Pruvost as a member of the extinct Order Palæodictyoptera.[2] However, examination of this fossil, which is now in the Peabody Museum at Yale University, convinces me that it is in reality part of a plant stem. A similar conviction was expressed by Dr. David White,[3] then paleobotanist of the United States Geological Survey, who studied the specimen shortly after it was found, although he did not publish his conclusion.

According to our present knowledge, therefore, the earliest unquestionable insects occur in Upper Carboniferous strata. This first occurrence is not extensive, but it does indicate the approximate time of origin of the insects. Let us return for a moment to the geologic timetable, and examine in more detail the Upper Carboniferous Period (Figure 2). This represents an interval of

---

[2] La Faune continentale du terrain Houiller du Nord de la France, p. 283.
[3] In a letter dated May 11, 1914, and on file in the Peabody Museum.

PERIOD	STAGES		INSECT ORDERS
PERMIAN	Upper		Coleoptera
	Middle		Thysanoptera, Perlaria
	Lower		*Protoperlaria, Protelytroptera,* Ephemerida, Odonata, Corrodentia, Hemiptera, Mecoptera, Neuroptera
UPPER CARBONIFEROUS	Stephanian		*Protohemiptera*
	Westphalian	C & D	*Megasecoptera, Caloneurodea*
		A & B	*Palaeodictyoptera,* Blattaria
	Upper Namurian		*Protodonata, Protorthoptera*

Figure 2. The First Occurrence of Insect Orders in the Permian and Carboniferous Periods. Names of exinct orders are italicized.

about thirty-five million years, and on the basis of its flora and fauna, is divided into three main stages, the Upper Namurian, Westphalian, and Stephanian. The record of insects is very scanty in the oldest of these; not until the late Westphalian and Stephanian rocks are insect remains sufficiently abundant and preserved to give us a concept of the fauna. Nevertheless, three species are known from the Upper Namurian, at the very base of the Upper Carboniferous, and they constitute the earliest record of the insects. One of these (*Erasipteron larischi* Pruvost), from Czechoslovakia, consists of part of a wing, which, though incomplete, clearly belongs to a member of the extinct Order Protodonata, related to the Odonata. Another fossil (*Stygne roemeri* Handl.), from Germany, is a nearly complete wing with orthopteroid features that place it in another extinct order, the Protorthoptera. The third specimen (*Metropator pusillus* Handl.), from Pennsylvania, is a very fragmentary wing which might have belonged to any one of several orders. Now this is truly a meagre record, but it does reveal two facts: *first,* insects with fully developed wings existed in the earliest part of the Upper Carboniferous Period, about 250 million years ago; and *second,* at least two orders, widely separated phylogenetically, occurred at that time. We can infer from this record that insects must have arisen at least as far back as the Lower Carboniferous in order for such diversity to be attained by the beginning of the Upper Carboniferous. This inference becomes even more obvious, when we bear in mind that morphological studies have shown that the most generalized or primitive insects were wingless, like the Thysanura. Apterous species must have existed, therefore, even before the winged ones.

So much for the first record of the insects. Let us now briefly consider the development of the class during the rest of the Paleozoic era. Referring again to the Upper Carboniferous table (Figure 2) we find that as we go up through the several stages, additional orders appear, and there is an increase in the total number of orders. From the lower half of the Westphalian stage (A and B) there are forty species known, representing the two orders previously mentioned (Protodonata and Protorthoptera), as well as the extinct order Palæodictyoptera and the existing order Blattaria or cockroaches. In the upper half of the Westphalian stage (C and D), about 15 million years after the first record of the insects, we come to the level of the Mazon Creek nodules in Illinois, second only to the Commentry shales in France as a source of Carboniferous insects. From this part of the Westphalian more than four hundred insects are known, representing the four orders already mentioned and in addition two other extinct ones, the Megasecoptera and Caloneurodea. From the Stephanian stage, which includes the Commentry deposit, about fifteen hundred species have been described, belonging to the orders previously mentioned as well as still another exinct one, the Protohemiptera. Thus, we see that by the end of the Upper Carboniferous seven orders of insects had come into existence, of which one, the Blattaria, survived for some two hundred forty million years to the present time.[4]

Let us now continue into the Permian Period (Figure 2), which represents an interval of about twenty-five million years. In the lower or oldest strata of the period eight orders have been found in addition to the seven which have persisted from the Carboniferous. Two of these, the Protoperlaria and Protelytroptera, are extinct, but the others are living orders. These are the Ephemerida, Odonata, Corrodentia, Hemiptera, Mecoptera, and Neuroptera. This fauna was an extremely interesting one, combining as it did eight extinct and seven existing orders. The Lower Permian was the last time, so far as our records now show, that the extinct orders outnumbered the existing ones. In Middle Permian rocks, Thysanoptera and Perlaria have been found; and in upper Permian strata the Coleoptera appear. These make a total of eighteen living and extinct orders of insects which came into existence before the end of the Paleozoic era, about two hundred million years ago; and of these ten are still living.

[4] I have not included in this account several extinct orders which are based upon very fragmentary specimens.

This brief survey gives an idea of the extent of the early insect life. The fauna was obviously a complex one—probably more so than we fully realize, for our present roster of the orders existing at the time is surely far from complete. Nevertheless, the variety of insect types probably fell far short of that which exists now, their biological environment being relatively simple. The plants of the time were largely seed-ferns and other gymnosperms; angiosperms were entirely absent, and, incidentally, did not arise for many millions of years later. It is difficult for us, living at a time when angiosperms dominate the plant world, to imagine a time of their complete absence; and equally difficult to imagine an extensive insect fauna without them. Also, there was a complete absence of birds and of mammals. Insects were then the only flying creatures on earth; they could readily escape by flight from their amphibian and reptilian enemies without danger of pursuit. Certainly the life of the insects must have been very different then from what it is now—with birds, bats, man, and DDT.

Our knowledge of the habits, life histories, and food of these early insects is necessarily slight, but certain inferences can be made from their structure, as we now know it. Let us see what this was like and what conclusions can be reached.

The order Palæodictyoptera, which existed during the Upper Carboniferous and Permian, is a negative and ill-defined group. Attempts to divide it into two or more orders have not proven successful, because some species seem to merge into the Ephemerida, and others into the Orthopteroids. Nevertheless, I believe that most of the one hundred fifty species which have been described are members of one order. Their closest living relatives are the Ephemerida and, to a lesser extent, the Odonata. The fact that all complete specimens are preserved with their wings outspread shows that, like the Ephemerida and Odonata, they were palaeopterous, i.e., unable to fold their wings back over the abdomen at rest. They had nearly similar fore and hind wings and were apparently weak fliers. Although they are mostly preserved as isolated wings, enough whole specimens have been found to give us a slight knowledge of their body structure. They were primitive insects, probably more so than any other known winged insects, but they did have some specializations. It should be noted, in this connection, that no remains of bodies of any insects have been found in the older half of the Upper Carboniferous strata. Not until we come to the Mazon Creek deposits, about 15 million years after the first record of the insects, are body remains known. This probably would have provided ample time for extensive specialization to develop. At any rate, the Palæodictyoptera were more primitive than any winged insects now living. They show about the same range in size as living dragonflies, many having a wing expanse of about two inches. The head was relatively small; the mouth-parts mandibulate and inconspicuous. Their antennæ are unknown, except for the proximal segments; probably they were moderately long and multisegmented. The thoracic segments and legs were nearly homonomous. The most striking characteristic of the Palæodictyoptera was the presence of paired membraneous lobes on the prothorax; these resembled miniature wings and are usually considered homologues of the functional meso- and metathoracic wings. The abdominal segments showed little differentiation, and the abdomen terminated in a pair of long, multisegmented cerci. Well preserved specimens have paired lateral lobes on each abdominal segment. The immature stages of the Palæodictyoptera are completely unknown. Several vague and fragmentary specimens, which are probably insect nymphs of some sort, have been assigned to the Palæodictyoptera, but they could just as well belong to certain other groups. The paired abdominal lobes of the adult have been generally interpreted as vestigial tracheal gills of the nymphs. This of course implies that the nymphs were aquatic; and in view of the close relationship between the Ephemerida and Odonata, both of which have aquatic nymphs, we may infer this to have been the case. From this you will see that our knowledge of the Palæodictyoptera is not great. Their general activities were probably much like those of the present-day may-flies, crawling and fluttering among the plants bordering the ponds or swamps in which their nymphs developed—inoffensive creatures whose only claim to fame is their antiquity and proximity to the great ancestor of all insects. They had no defense against the more powerful, predaceous insects which developed during the later Carboniferous and Permian, and for which they must have been easy prey.

Related to these Palæodictyoptera was another order of ephemerid-like creatures, termed the Megasecoptera. They were small to large insects, with a wing expanse ranging from one-half to five inches, and, like the Palæodictyoptera, they were unable to fold their wings over the abdomen. Until about 12 years ago they were known exclusively from the Upper Carboniferous; many Permian species have since been found, and it has become apparent that the order did not attain its greatest development until that period. They had moderately long antennæ, and extremely long cerci. In the Carboniferous species the head was small and short, but in some of the Permian types it was prolonged into a rostrum, probably much like that of the scorpion-flies. The older forms had mandibulate mouth-parts, and this was probably true also of the later species. The thorax and abdomen were slender, and, in the main, generalized in structure. In certain Carboniferous species, however, the prothorax was highly modified, bearing conspicuous projections or spines, which may have had some protective value. The legs of most were of the ordinary walking type, but in one Carboniferous genus (*Mischoptera*) the fore legs were short and raptorial in form though there are no other indications of predaceous habits. The wings were the most characteristic structures of the Megasecoptera. In most species they were very narrowed basally, and in one family they were arcuate, as in many families of living insects. Two abdominal structures are noteworthy: the very elongate cerci, which surpass in length those of most other insects; and, in certain families, lateral gill-like processes, resembling those of the Palæodictyoptera. Nothing is known of the immature stages of the Megasecoptera, but the presence of the supposed gill-vestiges just mentioned suggests that at least some of them had aquatic nymphs.

The Megasecoptera were probably no better fliers than the Palæodictyoptera, and their long cerci must have handicapped them in their attempts to escape from enemies. Perhaps this had something to do with their abrupt disappearance at the close of the Permian, for no sign of them has been found in later strata.

We next come to the insect dinosaurs—the Protodonata. These include the largest insects known, living or extinct. Although all species were large, as insects go, not all were giants, as is usually stated; some had a wing expanse of five inches, which is well within the limits of many living insects. Three very large species have been found, all belonging to the family Meganeuridæ. One, from the Carboniferous of France, was about twenty-six inches across the wings; the other two, from the Lower Permian of Kansas and Oklahoma, were somewhat larger, with a wing expanse of about thirty inches. The distribution of these species, both in space and time, indicates that the giant meganeurids inhabited an extensive area of the earth for some fifty million years, though the whole order became extinct shortly after the close of the Permian Period. The protodonates resembled dragon-flies in general appearance, and the earlier forms were probably directly ancestral to the true Odonata. They had large, toothed mandibles and spiny legs, and were undoubtedly predaceous. What they fed on, we can only guess. The contemporary slow moving Palæodictyoptera and Megasecoptera, which, because of their wing structure, were unable to hide easily among plants or under rocks, were probably their chief source of food. Protodonate nymphs are unknown. They were probably aquatic, although Dr. August Krogh has asserted that nymphs of the giant meganeurids could not have breathed through caudal or rectal tracheal gills, as odonate nymphs do, since in order to convey the necessary quantity of oxygen to the head, their tracheæ would have required a cross-section greater than that of the body itself. However, passage of oxygen in the tracheæ might well have been sufficiently aided by muscular movement to make this mechanism practical. At any rate, the adult Protodonata and Odonata are so much alike, I find it difficult to believe that their nymphs were very different.

The insects which we have been considering so far are primitive types which we would expect to find as part of early insect life. The group we are now to discuss is not in this category. For although their wings were of the palæopterous type, the head was modified into a long rostrum, with suctorial mouth-parts. The best preserved specimen (*Eugereon*) of this group has been found in Upper Permian rocks of Germany, but other representatives, also with elongate beaks, have been collected in Carboniferous strata of France, Belgium, and England. Since these insects were at first thought to have been related to the Hemiptera, Handlirsch termed the order the Protohemiptera. The choice of name was unfortunate, for, with the discovery of new specimens, it has become increasingly clear that they had nothing to do with the Hemiptera, but are instead closely related to the Palæodictyoptera. The order was obviously a widely distributed one, members having been found in Permo-Carboniferous strata of both Europe and North America; and specimens from Triassic rocks of Australia show that it persisted into the Mesozoic. The Triassic representatives, by the way, are remarkable in that the fore wings had a very large stridulatory area. The Palæozoic Protohemiptera had long cerci and well developed prothoracic wing lobes, like those of the Palæodictyoptera. The presence of suctorial mouth-parts raises the question of feeding habits. It is obvious from their modified mouth-parts that the Protohemiptera consumed liquid foods; whether this was plant juice, from such gymnosperms as lycopods, seed-ferns, and horse-tails, or the blood of reptiles and amphibians, is uncertain. But it is most interesting that as far back as the Upper Carboniferous, at least two hundred twenty-five million years ago, the suctorial mechanism had been developed in insects; and also that this device originated in relatives of the may-flies and dragonflies, quite independent of its subsequent development in the Hemiptera and the Diptera.

The largest extinct order of Carboniferous and Permian times was the so-called Protorthoptera. This included a bewildering variety of insects, suggestive of most of the orders to which we apply the term Orthopteroidea. Some show definite traces of characteristics found in the cockroaches, others recall the mantodean and even the saltatorial Orthoptera ; but so far no satisfactory division of the Protorthoptera has been proposed. All of them were neopterous, i.e., folded their wings over the abdomen at rest. The more primitive types, however, possessed pronotal lobes, like those of the Palæodictyoptera. Their wings were unequal, the hind pair having an expanded and plicate anal area. In certain Permian species, and perhaps also some Carboniferous ones, the fore wings were tegminous and distinctly punctate. A prominent ovipositor and cerci were present in most species. Apart from the wings, the prothorax showed the greatest amount of diversity. In many Carboniferous species, the prothorax was long and even armed with large spinous projections, whereas in others this segment was small and inconspicuous. The legs also showed much diversity. The fore legs of some were clearly raptorial,

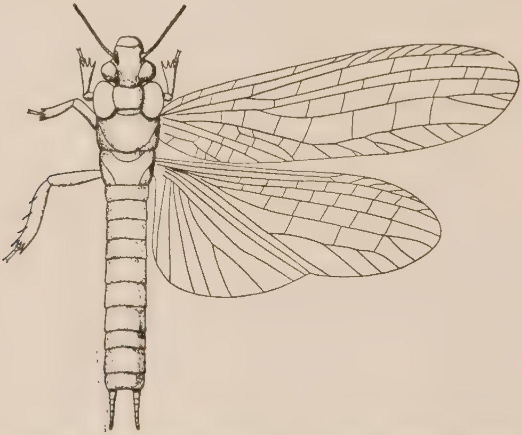


Figure 3. *Probnis speciosa* Sellards (Order Protorthoptera), from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoölogy.

long and armed with spines and teeth; in others they were curiously modified, perhaps for digging or climbing (Figure 3). The hind legs were specialized in some species for leaping, as in grasshoppers and crickets. It is apparent, therefore, that these early orthopteroids were a varied lot. They probably inhabited small seed-ferns, the phytophagous species feeding on the leaves and the predaceous ones on Palæodictyoptera and other defenseless insects. They were not very large creatures, though a few attained a wing-expanse of six inches. The nymphs of several families are known; they resembled the adults closely and were obviously terrestrial.

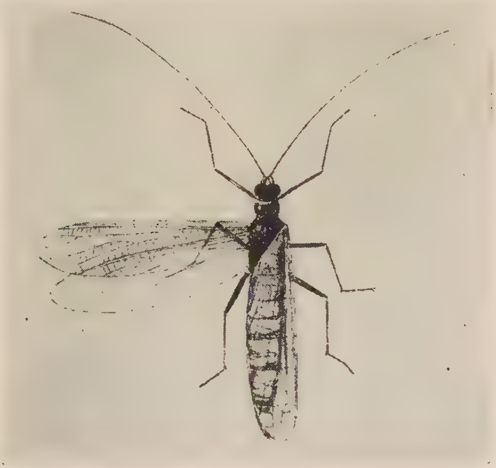


Figure 4. *Paleuthygramma tenuicornis* Martynov (Order Caloneurodea), from the Upper Permian of Russia. (After Martynov.)

Related to the Protorthoptera, but different enough to require ordinal separation, were the Caloneurodea, which existed during the Upper Carboniferous and Permian periods. They were slender insects, with long antennæ and tenuate wings (Figure 4). The largest of them had a wing expanse of five inches. They differed from the Protorthoptera chiefly in having hind wings like the fore wings, with no enlargement of the anal area. In general appearance the caloneurodeans probably resembled the long-horned grasshoppers, except that their legs were cursorial, not modified for jumping. Their nymphs are unknown.

The extinct orders which we have been considering have had a geologic record extending throughout the Carboniferous and Permian. We now come to two orders which are known only from the Permian period. One of these, the Protoperlaria, is the best known of all the extinct orders of insects, their remains being very abundant in Lower Permian rocks of Kansas and Oklahoma. The adults were similar to the existing stone-flies, but they had pronotal lobes like the Palæodictyoptera, five tarsal segments, and a distinct, though small, ovipositor. The abdomen had long cerci and nine pairs of vestigal lateral gills, recalling those of the Palæodictyoptera and some Megasecoptera. That they were vestigial gills is shown by the nymphs (Figure 5). These were well adapted to

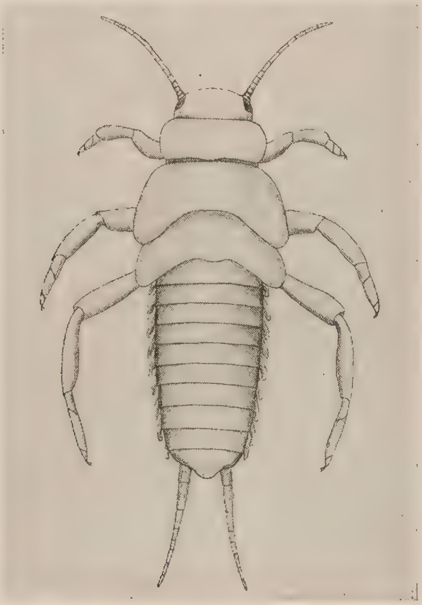


Figure 5. Protoperlarian nymph, from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoölogy.

an aquatic life, with swimming legs, and the lateral abdominal gills.

The other extinct Permian order is the Protelytroptera, which includes the most highly modified of all the Paleozoic insects. They had true elytra, very thick and convex, though with vestiges of venation (Figure 6). The hind wings were large, with a greatly expanded anal region, and with hinges on the longitudinal veins enabling the wing to fold up transversely as well as lengthwise. In general appearance these insects were highly suggestive of beetles, but the venation of their hind wings shows clearly that they were not at all allied to the Coleoptera. They might be related to the roaches or to the Dermaptera, but most likely they represent an early and independent origin of the elytrophorous condition. Nothing is known yet of their mouthparts or of their immature stages.

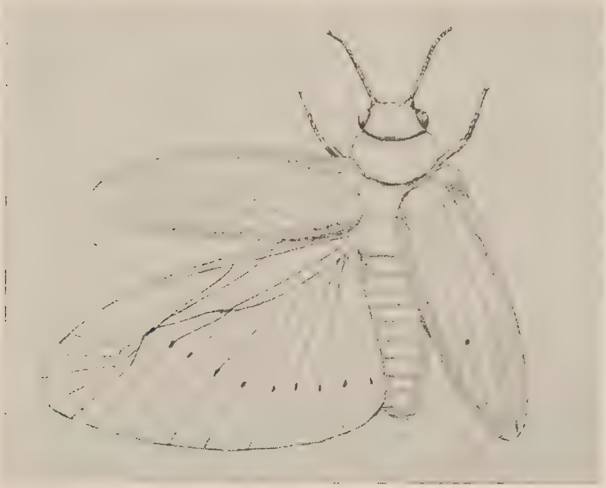


Figure 6. *Protelytron permianum* Tillyard (Order Protelytroptera), from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoölogy.

The foregoing discussion has dealt only with the *extinct* insect orders of the Upper Carboniferous and Permian periods. Let us now turn to the living orders. As we noted earlier, although ten of these are known from Paleozoic rocks, only one has a record which goes back to the Upper Carboniferous—the Blattaria or cockroaches. Their oldest remains are found in early Westphalian strata, which were deposited about two hundred forty million years ago. These first specimens consist only of wings, but complete or nearly complete specimens have been found in late Westphalian and Stephanian rocks. It is clear from these fossils that even that early in the earth's history, the roaches were not very different from what they are now. They were flat, and had a broad pronotum and tegminous wings like modern types. The venation, also, was similar to that which occurs in many of our living species—so much so that it is not easy to find obvious differences between Carboniferous and existing members of the group. Nymphal forms and several egg cases, which have been found in Permian rocks, serve to emphasize their similarity. Roaches are the most abundant of all Carboniferous insects. However, this does not necessarily mean, as it has usually been interpreted, that they were the prevailing insects of the time; it merely means that they were numerous in a particular region or environment. Most insect-bearing rocks were first deposited as mud, and the roaches presumably thrived in moist or damp regions having a luxuriant plant growth. The picture we get from the fossils can therefore be misleading, for it gives us a conception of the local biota only; if we had equally good samples of the fauna of dry regions, we would probably find the roaches less numerous. The size of the Paleozoic roaches has also been erroneously described. Although the statement is often made that giant roaches lived in the Carboniferous, no fossil specimens have been found which exceed the size of some of our living species. It is true, of course, that the *average* size of fossil roaches exceeds that of the existing species; but that is because the large roaches had a better chance of being preserved as fossils than the small ones. This selective aspect of preservation is often overlooked.

Let us now consider the existing orders which first appear in the Permian. The best known of these is the Ephemerida or may-flies, remains of which have been found in the Lower Permian rocks of Kansas and Oklahoma, as well as in Upper Permian deposits of Russia. They were about the same size as living may-flies, with a wing expanse of less than two inches. Their antennæ were much longer than those of existing species, however, and the prothorax was slightly broadened, with an indication of membranous lobes in some species. The abdomen, which terminated in long cerci and a median caudal filament, closely resembled that of Recent members of the order. The wings were their most interesting structures. Living members of the order, and even those from Mesozoic rocks, have greatly reduced hind wings; but in the Permian species, the hind wings were about equal to the fore wings in size, and had nearly the same venation. Some of the specimens from the Lower Permian of Kansas are clearly in the subimaginal stage, showing that this distinctive phase of ephemerid metamorphosis occurred even in those early days. Several nymphs, found in the Permian of Oklahoma and Russia, have the characteristics of living ephemerids—swimming legs, caudal filaments, and lateral abdominal gills.

True Odonata are represented in Permian strata only by wings. They have been found in Permian rocks in North America, Russia and Australia. Most species were surprisingly small, a few being less than an inch and a half across the wings. Both dragon-fly and damsel-fly types were present in the Lower Permian. Their nymphs are unknown, but they were almost certainly aquatic.

The Corrodentia or bark lice are relatively common in Permian strata. Like existing species, they were very small and even minute, most having a wing expanse of about half an inch, some a quarter of an inch. The body structure of a few Lower Permian species is well known. The head was relatively large, with long antennæ and prominent eyes (Figure 7). Surprising enough, the anterior part of the head was prolonged into a short rostrum, but whether the mouth-parts were adapted for chewing or some other method of feeding has not been determined.

At any rate the maxillary and labial palpi were conspicuous and generalized in structure. Another interesting feature of the early psocids was their wings. In existing species the hind pair are much smaller than the fore, with a reduced venation, but in the Lower Permian species the fore and hind wings were alike. Some of the Upper Permian members show the beginnings of hind wing reduction. Presumably these small creatures had essentially the same habits as many modern species, living under bark of trees or in leaf mould—but the trees and leaves were very different from those now inhabited by their descendants.

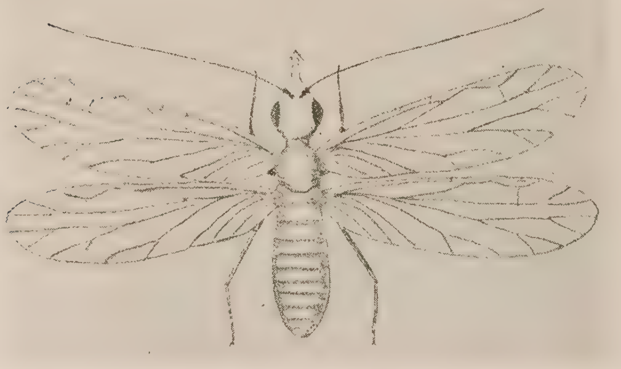


Figure 7. *Dichentomum tinctum* Tillyard (Order Corrodentia), from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoölogy.

All the true bugs, i.e., Hemiptera, of the Permian were members of the suborder Homoptera. Most of them were small, with a wing expanse of less than an inch, though in a few this reached two inches. The Lower Permian species were much less specialized than the Upper Permian ones, but they had the characteristic beak and maxillary and mandibular bristles of existing bugs. The wings are interesting because they were about equal in size, and because the hind wing had the venational features of psocid wings. The best known of the Lower Permian Hemiptera had a long, straight tube projecting from the end of the abdomen, but whether this was an ovipositor or respiratory tube remains to be determined. By Upper Permian time the Homoptera had developed a variety of families, some of them approaching certain existing families (Figure 8). There can be no doubt, on the basis of their known structure, that these early bugs had already settled down to a diet of plant juices.

We now come to the two remaining orders of insects which appear in the Lower Permian, the Mecoptera and Neuroptera. Their presence in Lower Permian rocks is interesting and surprising. Since existing members of both these orders have complete metamorphosis, we can conclude that the Permian species also had that type of development—unless, of course, we grant that complete metamorphosis might have arisen independently in the two orders, which seems improbable. True larval forms have been found in Permian deposits of Kansas, but their ordinal affinities have not been determined with certainty. The Lower Permian Mecoptera, or scorpion-flies, were very small, with a wing expanse of about an inch, though some of the later Permian species were more nearly the size of existing members of the order. Their body structure was much like that of certain living genera, such as the Australian *Chorista*, the head including a short rostrum (Figure 9). During the late Permian, and, inci-

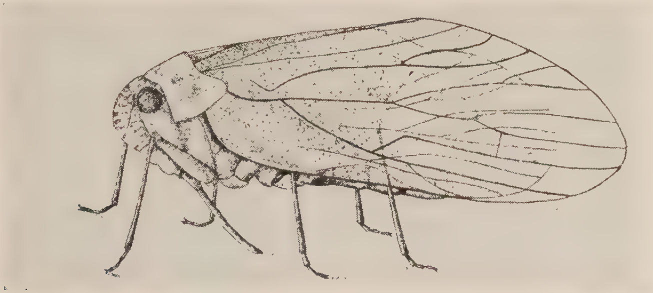


Figure 8. *Permocicada interga* Beck. (Order Hemiptera), from the Upper Permian of Russia. (After Becker-Migdisova.)

dentally, the early Mesozoic, the Mecoptera were relatively abundant and diverse. In one Permian deposit in Russia the Mecoptera make up 20% of the insect fauna found there, though at the present time they comprise less than .05% of the world's insect fauna. The Neuroptera of the Permian are no less interesting than the scorpionflies. Two distinct types occur in Lower Permian rocks—the Raphidiodea or snake-flies, and the Planipennia. Very little is known of their body structure, but their wings indicate that, whereas the Lower Permian snake-flies were primitive and closely related to existing families, the Planipennia were highly specialized, and only remotely related to existing groups. In Upper Permian rocks, however, the Planipennia are represented by an extensive series of fossils which are close to certain living families, such as the Berothidæ, Sisyridæ, etc.

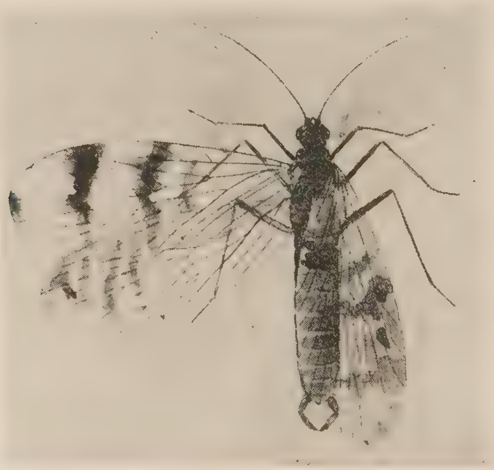


Figure 9. *Agetochorista tillyardi* Martynov (Order Mecoptera), from the Upper Permian of Russia. (After Martynov.)

There remain to be considered now three other orders, two of which, the Thysanoptera and Perlaria, appear first in Middle Permian rocks, and the third, Coleoptera, in late Permian deposits. The earliest Perlaria have been found in Russian strata and although they are very fragmentary, their identification is substantiated by the presence of more definite specimens in late Permian rocks of Australia. The latter were considered by Tillyard as being very closely related to the existing Eustheniidæ of the Australian region. The Thysanoptera or thrips, also found in Russian deposits, are of course minute and the details of the wings are not known; but the fossils certainly show the general characteristics of the thrips.

The first unquestionable Coleoptera, or beetles, are found in the Upper Permian of Russia and Australia. Unfortunately, complete specimens are unknown, though several well preserved elytra have been found. The family relationships of the fossils cannot be ascertained on these structures alone; but several types of elytra are represented, including some which are alike those of the Cupedidæ, and others which recall those of the Hydrophilidæ. It should be noted that since beetles are very abundant in Triassic deposits, their presence in the Permian is not surprising.

This then, is a general picture of early insect life. Our knowledge of it is limited, and there are many gaps to be filled, but we do have some idea of its nature. In reality, two faunas existed during the geologic periods considered—a Carboniferous fauna and a Permian one. The contrast between these two is fully as great as that between the faunas of the Triassic and the present. Even by late Permian time, about one-third of all the living orders of insects had come into existence, and the abrupt appearance of so many existing orders in the Lower Permian suggests that some of them lived in Carboniferous time, though not yet found in strata of that period. This early insect fauna included both predators and plant feeders, some of which had suctorial mouth-parts. The metamorphosis of the Carboniferous species, so far as known, was of the incomplete type, some apparently having aquatic nymphs; but by early Permian time, complete metamorphosis had been acquired. All of this took place before the existence of flowers or mammals or birds—to say nothing of man. It is no wonder that the insects have such a tenacious hold on what we consider to be our planet.

A LIST OF SPIDERS FROM MONA ISLAND, WITH DESCRIPTIONS OF NEW AND LITTLE KNOWN SPECIES[1]

By Elizabeth B. Bryant
Museum of Comparative Zoölogy

The small Mona Island, between Haiti and Puerto Rico, is rarely visited by collectors and its spider fauna is little known. In 1914 Mr. N. Banks described two new species from there in a short paper published in the Bulletin of the American Museum of Natural History, and much later, 1929–1930, Dr. A. Petrunkevitch noted in his "Spiders of Porto Rico" fifteen species, of which three were new.

Recently, two small collections from Mona have been received by the Museum of Comparative Zoölogy. The first was from Dr. Serrallés of Puerto Rico, who spent a week there during April, 1944. He very kindly sent the material to me for identification. The second collection was from Mr. Harry Beatty, who spent the month of August of the same year there. Neither collection is large, either in species or specimens, but as the island is small and not very diversified, the spider fauna probably is small. Four species are new.

This paper lists the forty-one species that have been reported from Mona and includes descriptions of the four new species and the hitherto unknown form of *Hentzia squamata* (Petr.), with elongate mandibles. Collecting at a different season would undoubtedly add many more species.

The following is a list of the species collected by Dr. Serrallés in April and by Mr. Beatty in August 1944.

Fam. Filistatidæ

♀ *Filistata hibernalis* Hentz Apr.Aug.

Fam. Œcobiidæ

♀ *Œcobius benneri* Petr. Apr.

---

[1] Published with a grant from the Museum of Comparative Zoölogy at Harvard College.

FAM. OXYOPIDÆ

♀ *Peucetia viridans* Hentz Aug.
♀ *Oxyopes salticus* Hentz Aug.
♀ *Hamataliwa haytiana* (Chamb.) Apr.

FAM. PHOLCIDÆ

♀ *Physocyclus globosus* (Tacz.) Apr.Aug.

FAM. THERIDIIDÆ

♂ ♀ *Anelosimus studiosum* (Hentz) Apr.
♂ ♀ *Conopistha argyrodes* (Walck.) Apr.Aug.
♂ ♀ *Latrodectus mactans* (Fabr.) Aug.
♀ *Theridion insulicola* spec. nov.

FAM. ARGIOPIDÆ

pullus *Aranea displicata* (Hentz) Apr.
♂ ♀ *Argiope argentata* (Fabr.) Apr.Aug.
♀ *Cyclosa caroli* (Hentz) Aug.
♀ *Eriophora* (scape broken) Apr.Aug.
♀ *Edricus crassicauda* (Keys.) Aug.
♀ *Eustala anastera* (Walck.) Aug.
♀ *Gasteracantha cancriformis* (Linn.) Apr.Aug.
♀ *Leucauge argyra* (Walck.) Apr.
♀ " *regni* (Simon) Apr.
♂ ♀ *Metepeira virginensis* Chamb. and Ivie Apr.
♀ *Neoscona volucripes* (Keys.) Apr.
♂ ♀ *Nephila clavipes* (Linn.) Apr.Aug.
♀ *Parawixia cambridgei* Bryant Aug.
♂ ♀ *Wixia serrallesi* spec. nov.

FAM. SPARASSIDÆ

♀ *Stasina macleayi* Bryant Apr.
♂ *Olios bicolor* Banks Aug.
♀ *Heteropoda venatoria* (Linn.) Apr.

FAM. SELENOPIDÆ

♂ ♀ *Selenops insularis* Keys. Apr.Aug.

FAM. THOMISIDÆ

♂ ♀ *Misumenops celer* (Hentz) Aug.

FAM. CLUBIONIDÆ

♂ ♀ *Aysha tenuis* (L. Koch) Apr.Aug.
♂ ♀ *Chiracanthium inclusum* (Hentz) Aug.
♀ *Wulfila immaculata* Banks Aug.

FAM. SALTICIDÆ

♂ ♀ *Habronattus translatus* (Peckham) Aug.

♂ ♀ *Hentzia squamata* (Petr.) Apr.Aug.
♂ ♀ *Sidusa mona* spec. nov. Aug.
♀ *Stoides placida* spec. nov. Aug.

The following is a list of species reported from Mona but not seen by me.

FAM. OXYOPIDÆ

Oxyopeidon rana Simon (Petrunkevitch, 1929)

FAM. ARGIOPIDÆ

Argiope trifasciata (Fabr.) (Petrunkevitch, 1929)

FAM. CTENIDÆ

Oligoctenus ottleyi Petrunkevitch (1930)

FAM. THOMISIDÆ

Misumenops asperatus (Hentz) (Petrunkevitch, 1930)

FAM. SALTICIDÆ

Siloca minuta Petrunkevitch (1930)

FAM. THERIDIIDÆ

Theridion insulicola spec. nov.

Figure 1

Female. Length, 3.0 mm., ceph. 1.2 mm., abd. 1.7 mm. long, 1.6 mm. wide.

Cephalothorax pale, shining, very slightly convex, anterior margin less than half the greatest width, widest between the third pair of legs, thoracic groove covered with a broad black line that does not reach the ocular area or the posterior margin, row of black bristles from the p.l.e. to the groove and two long median bristles between the groove and the posterior eyes; *eyes* cover the anterior margin, anterior row recurved, a.m.e. largest of the eight, separated by less than a diameter, and from a.l.e. by a radius, posterior row straight, eyes equidistant, lateral eyes subequal and touching, p.m.e. separated by less than a diameter, each eye surrounded by a black ring; *quadrangle* higher than wide and narrower behind than in front; *clypeus* higher than the eye area, a small median black spot on the margin; *mandibles* pale, shaded with gray on the median margin, long, cone-shaped, weak, groove short, fang short; *labium* fused to the sternum, wider than long, tip not narrowed; *maxillæ* almost twice as long as the labium, slightly inclined, tips transverse; *sternum* pale, shaded with gray about the margins and a short median gray stripe at the tip, triangular, as wide as long, ending in a broad round tip in front of the fourth coxæ, fourth coxæ separated by more than a diameter; *abdomen* pale, with a short median gray spot at base, followed by a pair of converging gray spots, entire abdomen covered with black granules, each bearing a long colorless bristle, strongly convex, almost as wide as long, venter a dull yellow with small pale spots; *legs*, 1–2–4–3, not varying much in length, pale, with black spots on ventral side, so that the legs have a spotted appearance, no spines but rows of hairs and bristles, III and IV tibiæ with a median dorsal bristle; *epigynum*, area wider than long, divided by a narrow median septum, each side pale oval areas, which probably are the openings, near the posterior margin and below the surface, each side, a transverse oval sac, with a small circular sac just anterior.

Holotype ♀ Mona Island, 5 April 1944 (Serrallés).

Theridion insulicola differs from *Theridion antillanum* Simon, from St. Vincent, and reported by Petrunkevitch from Puerto Rico, by the smaller size, the quadrangle of median eyes narrower behind, and the black granules on the abdomen. These granules are very conspicuous, even after the long bristles have been broken off.

FAM. ARGIOPIDÆ

Genus *Parawixia* F.O.P.-Cambridge 1903

Parawixia cambridgei Bryant

Parawixia cambridgei Bryant, 1940, p. 342, figs. 104–106. "♂ ♀ Cuba; Oriente, coast below Pico Turquino, June 1936" (Darlington).

This species was described from the Oriente, Cuba, and afterwards found in a collection from Diquini, Haiti, made by Dr. W. W. Mann. It has the same number of tubercles on the abdomen as *Marxia grisea* McCook, American Spiders, 1893, 3, p. 195, pl. 13, fig. 10, described from a female, 8.00 mm. long, from Biscayne Bay, Florida. The two genera belong to separate sections of the family. The male of *Marxia* has two long bristles on the patella of the palpus, and both male and female have five teeth on the lower margin of the fang groove. The male of *Parawixia* has but one bristle on the patella of the male palpus, and the lower margin of the fang groove has but three teeth. McCook does not state the number of teeth on the fang groove and he evidently placed the species in the genus *Marxia* because of the abdominal tubercles. He does describe the cephalothorax rather definitely, as "divided into two low ridges by a lateral depression passing just behind the ocular quad, giving the head a lumpy appearance." These two low elevations just posterior to the eyes are even more conspicuous in the male than in the female but until the number of teeth on the fang groove on the type specimen is known, the two can best be considered as separate species.

♀ Mona Island, August 1944 (Beatty).

Genus *Wixia* O.P.-Cambridge 1882

Wixia serrallesi spec. nov.

Figures 2, 3

Male. Length, 6.6 mm., ceph. 3.1 mm. long, 3.0 mm. wide, abd. 3.6 mm. long, 2.8 mm. wide.

Cephalothorax brown, with a broad pale median stripe from the lateral eyes to the posterior margin, anterior margin shaded with brown and a mass of white hairs posterior to the lateral eyes, a narrow marginal pale stripe, anterior margin about half the greatest width, sides evenly rounded, eye area carried foreward, cephalothorax rather flat, thoracic groove long and deep; *eyes* in three groups, anterior row strongly recurved, a.m.e. largest of the eight, convex, separated by about a diameter, p.m.e. slightly smaller than the a.m.e., separated by almost two diameters, a short bristle between each a.m.e. and p.m.e., lateral eyes small, subequal, on a common tubercle, a long bristle anterior and another posterior to the tubercle; *quadrangle* of median eyes slightly narrower behind and not as high as wide; *clypeus* below a.m.e. less than a diameter of a.m.e.; *mandibles* dark brown, vertical, small, cone-shaped, fang groove oblique, four teeth on the upper margin, the second tooth from base of the fang the smallest, lower margin with four small, subequal teeth; *labium* fused to the sternum, brown, tip rebordered and pale, wider than long; *maxillæ* brown, distal half pale, about twice as long as labium; *sternum* pale, triangular, three-quarters as wide as long, widest between the second coxæ and pointed in front of the fourth coxæ, coxæ pale, I coxa with a hook, III and IV coxæ with a strong dark cusp or spine about the middle, IV trochanter with a cusp; *abdomen* oval, with a pair of well-defined tubercles between the shoulder angles that extend upwards, first pair of muscle spots between the tubercles, a median basal pale stripe heavily outlined with black spreads towards the tubercles and fades posteriorly, a vague dark spot between the second pair of muscle spots, entire abdomen with scattered long bristles, venter dark with a pair of pale spots anterior to the spinnerets; *legs*, 1–2–4–3, III left missing, all joints pale with broad dark bands, median on femora, basal, median and distal on tibiæ and metatarsi, spines, I pair, femur, dorsal, 3 whorls, ventral, 11 pairs, the 6 spines at the distal end of the prolateral row, very long and strong, patella, 1 at the tip, prolateral, 2, retrolateral, 1, tibia, spines scattered on the dorsal and ventral sides, metatarsus, ventral, 0, II pair, femur, dorsal, in 3 whorls, ventral, a prolateral row of 11 spines, patella same as I pair, tibia, bent, ventral, 4 pairs of strong spines with a curved tip, each from a raised base, III pair, femur, 2 small ventral spines near the base, IV pair, femur, ventral, prolateral row with 4 basal strong spines each from a raised base, retrolateral row only at the distal end; *palpus* not as long as the cephalothorax, patella with 1 long strong bristle, tibia about as long as wide, paracymbium long with a truncate tip, clavis long, with a broad recurved spur from the base, tip extends far beyond the cavity, embolus probably a very small, short black spur near the tip.

Female. Length, 9.0 mm., ceph. 3.2 mm. long, 3.0 mm. wide, abd. 7.9 mm. long, 5.5 mm. wide.

Cephalothorax brown, covered with short white hairs, the pale stripe much narrower than in the male, eye area not carried forward as much as in the male; *eyes* same as in the male; *mandibles* brown, vertical, fang groove oblique, upper margin with three teeth, middle tooth the largest, lower margin with two widely separated teeth; *mouth* parts and *sternum* same as in the male, no spurs on coxæ or trochanter; *abdomen* dorsal tubercles not as distinct as in the male but the markings the same; *legs,* 1–2–4–3, much darker than in the male, spines, femora with 0 ventral spines, I pair, femur, dorsal, small and scattered, 3 strong prolateral spines, patella, prolateral, 2, retrolateral, 1, tibia and metatarsus, spines small and not paired, II pair, tibial spines not modified; *epigynum,* chitinized area longer than wide, a wide spoon-shaped scape, deeply depressed in the middle area with the tip rebordered.

Holotype ♂ Mona Island, August 1944 (Beatty). Allotype ♀ Mona Island, August 1944 (Beatty). Paratype ♂ Mona Island, 6 April 1944 (Serrallés), I pair of legs missing. Paratypes 2♀ Mona Island, August 1944 (Beatty), probably in the penultimate moult.

The genus *Wixia* was based by O.P.-Cambridge in 1882, on the species *abdominalis* known only from the female from the Trail collection from the Amazon. In 1889, he erected the genus *Amamra* in the Biol. Centrali-Americana, 1, p. 55, for five species from Central America. A few years later, in the second volume of the Biol., F.O.P.-Cambridge placed this genus as a synonym of *Wixia* but he gave no reason for so doing.

Wixia serrallesi does not agree perfectly with the definition of the genus as given by F.O.P.-Cambridge. The eyes are the same in both male and female, with the a.m.e. the largest, the clypeus is less than a diameter of a.m.e., instead of very high, the abdominal tubercles are small in both male and female. Eventually, the genus *Amamra* may be revived, either as a distinct genus or a subgenus of *Wixia,* and *serrallesi* would be placed with it, rather than in the genus *Wixia,* which has large abdominal tubercles and the quadrangle of median eyes square.

Wixia serrallesi is very near to *Wixia clivosa* (O.P.-Camb.) known from both male and female from Mexico and placed by O.P.-Cambridge in the genus *Amamra.*

Both have a very long clavis that has a circular sweep outside the cymbium and both have the median area of the scape depressed.

FAM. SALTICIDÆ

Genus *Hentzia* Marx 1883

Hentzia squamata (Petrunkevitch).

Wala squamata Petrunkevitch, 1930, p. 146, figs. 130–134. "several ♂s and ♀s, from Mona Island, 24 February 1914, in the collection of the American Museum of Natural History."

The specimens described by Dr. Petrunkevitch all had the short vertical mandibles. Six males and six females were collected by Beatty in August, 1944. Three of the males have the short mandibles and the others have mandibles of varying length. When the mandibles are long and porrect, the two teeth on the promargin are widely separated, one near the base of the fang and the other near the base of the joint. The large tooth on the retromargin is much nearer the tooth at the distal end, than to the second tooth that is almost hidden by the scopula of the maxillæ. The largest male is 6.0 mm. long with the cephalothorax, 2.5 mm. long and 2.2 mm. wide. The mandibles are 2.0 mm. long, with the outer margins parallel and fringed with long white hairs; the inner margins are touching on the basal quarter and then gradually narrow to the width of the fang. On the specimens with the long, porrect mandibles, the fang is longer than the basal joint with the distal third very slender and curved.

In all specimens of females, the mandibles are vertical, rather thick, with a large bicuspid tooth on the retromargin. A large female is 6.7 mm. long.

The species is very close to *Hentzia peckhami* (Cockerell), 1893, from Jamaica, (*Anoka moneagua* Peckham, 1894). This species is smaller and all of the type specimens of the Peckham species from Moneague, have short mandibles, with no white scales, either on the mandibles or on the cephalothorax. The females are also small and dark. The epigynes are very similar.

Genus *Stoides* Simon 1901

Stoides placida spec. nov.

Figure 4

Female. Length, 3.4 mm., ceph. 1.5 mm., abd. 2.1 mm. *Cephalothorax* dark brown, ocular area covered with golden iridescent scales, a large pale transverse spot, twice as wide as long on slope posterior to the dorsal eyes, probably in life covered with white scales as a few remain on the lateral margins, a few white scales on margin above the posterior legs, clypeus with white scales, cephalothorax very high, widest posterior to the dorsal eyes, in a lateral view, slightly depressed posterior to the ocular area, then sloping very gradually to near the posterior margin where it falls abruptly, thoracic groove very short and faint; *eyes,* anterior row recurved, so that the posterior margins form a straight line, the eyes inclined downward, so they can not be seen from the dorsal view, a.m.e. very large, almost touching, a.l.e about a radius of a.m.e. and separated from them by less than a diameter of a.l.e., eyes of the second row midway between the first and third rows, eyes of the third row subequal with a.l.e. and on the extreme margin of the carapace; *quadrangle* slightly narrower behind than in front and about two-thirds as long as wide; *clypeus* retreating, about two-thirds as wide as the diameter of a.m.e., with a long recurved bristle between a.m.e.; *mandibles* brown, with many white scales, rather small, cone-shaped, fang groove short, no teeth on either margin, fang short with a very thick base; *labium* pale, longer than wide, tip pointed; *maxillæ* pale, one and a half times as long as labium and inclined; *sternum* pale brown, about as long as wide, convex, fourth coxæ almost touching; *abdomen* a broad oval, dorsum flat with scattered scales and white hairs and longer dark hairs or bristles, a short dark basal band, followed by a pale brown median stripe with irregular margins, on anterior half a pair of large brown spots, followed on the posterior half by a pair of darker brown spots, venter pale with three narrow brown stripes, spinnerets pale, long, closely grouped and extending some distance from the abdomen; *palpi* pale, patella and tip of femur with white scales; *legs,* 4–3–1–2, pale, femora with basal and distal dark rings, more distinct on ventral side, posterior tibiæ with basal and distal dark rings, scattered white iridescent scales on distal joints, spines, I pair, no patella spines but a long trichobothria at the tip, tibia, dorsal, 0, ventral, 2 distal, 1–1r, prolateral, 1, metatarsus, dorsal, 0, ventral, 2–2, II pair the same as I pair, III and IV pairs, patellæ with prolateral and retrolateral spines, a dorsal basal spine on tibiæ, tibiæ spiny, metatarsi with three whorls of spines; *epigynum,* the pair of spermatheca separated by almost two diameters, with smaller sacs just anterior which are separated by about a diameter, between the two sacs a depressed area.

Holotype ♀ Mona Island, August 1944 (Beatty).

The genus *Stoides* was based by Simon on *Prosthesima pygmæa* Peckham from St. Vincent. Later the Peckhams added to the genus, *Attus auratus* Hentz, common in the southern part of the United States. It is questionable if the latter species belongs in the genus. The types of *Prostheclina pygmæa,* both male and female, were probably returned to the British Museum and the co-types, an adult female and an immature specimen, retained by the Peckhams and are now in the Museum of Comparative Zoölogy collection. They are old and very much rubbed but probably once had hairs and scales on the cephalothorax. In the female the second row of eyes is plainly midway between the first and third rows as stated by the Peckhams. Simon in the description of the genus, places the eyes of the second row nearer the third than to the first row. *Stoides placida* is congeneric with *Stoides pygmæa* (Peck.). It is slightly larger and has the anterior row of eyes more retreating so that the eyes are not visible from the dorsal side.

Genus *Sidusa* Peckham 1895

Sidusa mona spec. nov.

Figures 5, 6

Male. Length, 4.5 mm., ceph. 2.4 mm. long, 1.6 mm. wide, abd. 2.1 mm.

Cephalothorax dark brown, ocular area covered with white scales with scattered dark bristles, the white scales extend in a long point behind the dorsal eyes half way to the posterior margin, marginal stripe of white scales, cephalothorax moderately high, highest posterior to the dorsal eyes, widest posterior to the dorsal eyes, posterior margin about two-thirds as wide as the anterior, thoracic groove short, in a shallow depression covered with white scales; *eyes* cover about one-third of the carapace, anterior row strongly recurved, a.m.e separated by little more than a line, a.l.e. about a radius of a.m.e., separated from them by less than a radius of a.l.e., second row of eyes midway between first and third rows, third row of eyes slightly narrower than the first row, eyes not on extreme margin, subequal with a.l.e.; *quadrangle* about half as wide as long; *clypeus* slightly protruding, about as wide as a radius of a.m.e.; *mandibles* brown, vertical, rather short, promargin of fang groove with 3 teeth near the median margin, retromargin poorly defined with no teeth, fang with a heavy base, as long as groove; *labium* pale brown, about as wide as long; *maxillæ* pale, about one and a half times as long as labium; *sternum* dark brown, with a few long white hairs, three-fifth as wide as long, first pair of coxæ separated by a little more than a diameter, fourth pair almost touching; *abdomen* oval, covered with short white hairs and longer dark bristles, a pair of wide dark stripes, heavier at the base show beneath the white hairs, venter pale; *legs*, 4–1–3–2, pale, with white scales and longer dark hairs, I pair with a prolateral dark mark on the tibia, IV pair with the femur darker at the tip, spines, I pair, patella, prolateral, 1, tibia, dorsal, 0, ventral, 2–2, followed by 1r, retrolateral, 0, prolateral, 1–1, metatarsus, ventral, 2–2, II pair, patella, lateral, 2, tibia, ventral, 2 distal followed by 1–1r, prolateral, 1–1, retrolateral, 1, metatarsus, ventral, 2–2, retrolateral, 1, III and IV pairs with dorsal basal spine on tibiæ, patellæ with prolateral and retrolateral spines, whorl at the tip of the metatarsi; *palpus* about as long as cephalothorax, femur and patella pale, covered with white scales, tibia and cymbium darker, both with many long dark hairs, tibia but little longer than the patella, about as wide as long, tibial apophysis a long slender spine parallel to the cymbium and almost reaches the tip of the palpal organ, palpal organ small and confined to the basal two-thirds of the joint, embolus a strong black spine with a heavy base and does not extend beyond the cavity.

Female. Length, 5.5 mm., ceph. 2.6 mm. long, 2.0 mm. wide, abd. 3.6 mm. long, 2.1 mm. wide.

Cephalothorax brown, covered with white scales and longer dark bristles in the eye area, widest just posterior to the dorsal eyes; *eyes* same as in the male; *clypeus* covered with white hairs, less than a diameter of a.m.e.; *mandibles* pale brown, vertical, promargin of the fang groove with three teeth, retromargin with no teeth; *sternum* and *mouth parts* same as in the male; *abdomen* oval, covered with white hairs and longer dark bristles, with the pair of broad lateral dark stripes showing under the white hairs as in the male, on the posterior half the dark stripes broken into two pairs of spots, venter pale; palpi pale, covered with white hairs; *legs,* 4–1–3–2, pale with a dark prolateral spot near the tip of the first femur, spines the same as in the male; *epigynum* shows little exterior structure, two lobes with deeply chitinized margins and dark spermatheca near the posterior margin.

Holotype ♂ Mona Island, August 1944 (Beatty). Allotype ♀ Mona Island, August 1944 (Beatty). Paratypes several ♂s ♀s Mona Island, August 1944 (Beatty).

Sidusa mona is closely related to *Sidusa pavida* Bryant, from the Virgin Islands. The former has the tibial apophysis of the palpus much longer and the embolus heavier. Neither belong to the genus *Sidusa* in the sense used by either Peckham or Simon, as there is no tooth on the retromargin of the fang groove and there is a dorsal basal spine only on the posterior tibiæ. But F.O.P.-Cambridge has placed in the genus several of the Peckham genera that eventually may be recognized.

LITERATURE CITED

Banks, N.
1914. New West Indian Spiders. Bull. Amer. Mus. Nat. Hist., 33: 637–642, pl. 43.

Bryant, Elizabeth B.
1940. Cuban Spiders in the Museum of Comparative Zoology. Bull. Mus. Comp. Zool., 86: 249–532, pls. 1–22.

1942. Notes on the Spiders of the Virgin Islands. Bull. Mus. Comp. Zool., 89: 317–363, pls. 1–3.

Cambridge, F.O.P.-

1899–1905. Arachnida; Araneides and Opiliones. 2: XII + 610, pls. 1–54. Biologia Central-Americana.

Cambridge, O.P.-

1889–1902. Arachnida; Araneidea, 1: XV + 317, pls. 1–39. Biologia Central-Americana.

McCook, Henry C.

1893. American Spiders and Their Spinning Work. Philadelphia, 1: 1–284, pls. 1–30.

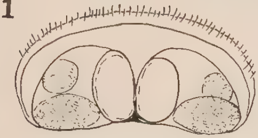
Petrunkevitch, Alexander

1929–1930. The Spiders of Porto Rico. Trans. Conn. Acad., 30: 1–355, figs. 1–240; 31: 1–191, figs. 1–168.

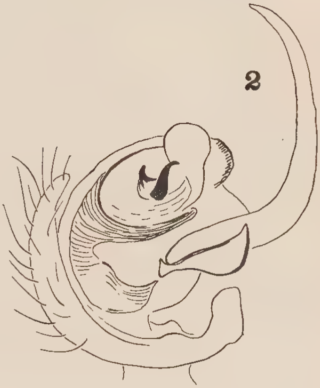
EXPLANATION OF PLATE 4

Fig. 1. *Theridion insulicola* spec. nov., epigynum.
Fig. 2. *Wixia serrallesi* spec. nov., left palpus, ventral.
Fig. 3. *Wixia serrallesi* spec. nov., epigynum.
Fig. 4. *Stoides placida* spec. nov., epigynum.
Fig. 5. *Sidusa mona* spec. nov., left palpus, ventral.
Fig. 6. *Sidusa mona* spec. nov., epigynum.

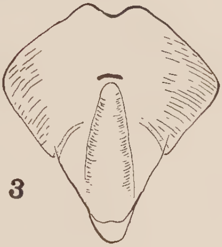
1



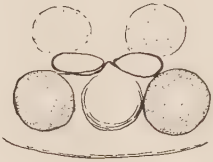
2



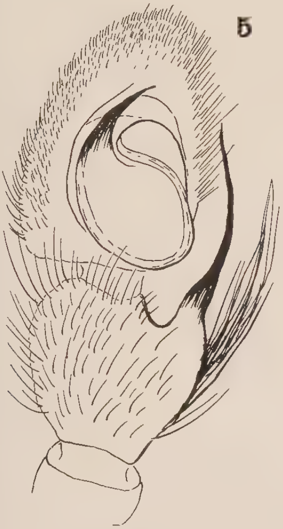
3



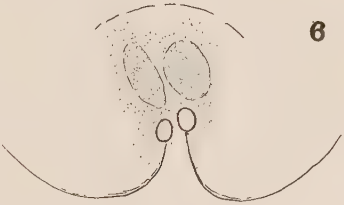
4



5



6



BRYANT—SPIDERS FROM MONA ISLAND

TAXONOMIC NOTES ON THE DILARIDÆ (NEUROPTERA)[1]

By F. M. Carpenter
Harvard University

The little-known family Dilaridæ has been represented in the New World by two genera, *Nulema* and *Nallachius*. *Nulema,* which is based upon *championi* Navas (1914), from Guatemala, is very close to *Nallachius* and may turn out to be synonymous with it. *Nallachius* has included seven species from the Neotropical and Nearctic regions. Its genotype, *prestoni* McLachlan, has been inadequately known, the type of the species only recently becoming available for study at the British Museum. In reply to my inquiry about this type, Mr. D. E. Kimmins kindly sent me excellent drawings of its venation and abdomen. On the basis of this information and the examination of specimens of other species in the Museum of Comparative Zoölogy, I am redefining here the genus *Nallachius,* with a review of the known species; describing a new species of *Nallachius* from Paraguay; and proposing a new genus for one of Banks' species from Colombia.

Navas' grouping of the dilarid genera into two tribes, Dilarini and Nallachiini, was mainly based upon the width of the subcostal space and the number of subcostal veinlets. In all probability, however, the width of the subcostal space is merely correlated with the size of the insect and does not represent a phylogenetic division of the family. On the number of subcostal veinlets Navas was clearly in error, for in this respect not even the genotype of *Nallachius* fits his definition of the genus. He also pointed out that whereas all the Dilarini are restricted to the Old World, the Nallachiini occur exclusively in the New World. This is no longer true, however, for *hermosa* Banks, from Colombia, obviously falls into the Dilarini. In defense of Navas' classification, however, it should be noted that there are certain general differences between the members of the tribes Dilarini and Nallachiini. The former are relatively large, with a wing expanse of 20 mm. or more, whereas the Nallachiini have a wing expanse of less than 10 mm. Furthermore, the wings and antennæ of the Dilarini show much less sexual dimorphism than they do in the Nallachiini. But these are differences in degree and will undoubtedly break down as more species are known. I believe that a more satisfactory and distinctly phylogenetic division of the family might be attained on the structure of the male genital armature and of the media and cubitus of the wings, as in other families of the Neuroptera (Hemerobioidea and Raphidioidea; see Carpenter, 1935, 1940). Some evidence for this has already been obtained and will be presented in a later paper on the Dilaridæ.

---

[1] Published by a grant from the Museum of Comparative Zoölogy at Harvard College.

Genus *Nallachius* Navas

Nallachius Navas, 1909, Mem. Real. Acad. Ciénc. Art. Barcelona, 7(17): 665; Navas, 1914, Gen. Insectorum, 156: 11.

Male: antennæ with long pectinations (usually 9–12). Fore wing distinctly triangular, coastal space of moderate width, traversed by numerous branched or unbranched veinlets; subcostal space narrow, with from 2–7 short veinlets; Rs usually with 4–5 main branches; MA always anastomosed proximally with Rs. Hind wing about two-thirds as long as the fore wing; Rs usually with one main branch less than in the fore wing. Genital armature consisting of a transverse proximal plate, two pairs of slender processes extending posteriorly from the plate, and a median ædeagus.

Female: antennæ filiform, as in other female Dilarids. Fore wing: more slender than that of the male, but with essentially the same venation. Hind wing: about two-thirds the length of the fore wing. Venation as in the male.

Genotype: *Dilar prestoni* McLachlan.

Navas' diagnosis of this genus is not entirely satisfactory. His statement that the subcostal space of the fore wings contains almost no veinlets, in contrast to the several veinlets in *Dilar,* etc., is not true; even in the type of *prestoni* there are seven subcostal veinlets. *Nallachius* is undoubtedly a valid genus, however. It differs from *Dilar* and the other Old World genera by the triangular fore wings of the male, the long antennal pectinations of the male, the smaller number of cross-veins in the fore wings, the reduced hind wings of both sexes, the sexual dimorphism of the wings, and especially the male genital armature. It is impossible to give a more precise generic diagnosis at this time because of the few species known in the genus. In addition to *prestoni* the genus includes *americanus* McL., *pulchellus* Banks, *bruchi* Navas, *loxanus* Navas, and *reductus,* n. sp., described below; and of these only *americanus* and *pulchellus* are known (in the literature) by both sexes. Furthermore, in the course of making this study, I have noted that the fore wings of *americanus* (and presumably also of *loxanus*) differ from those of the other species mentioned by having the posterior branch of MP anastomosed with CuA for a short interval. This is a very striking and unusual characteristic to find in the Neuroptera, and may turn out to be of generic significance, when the venation of *loxanus* is known for certain.

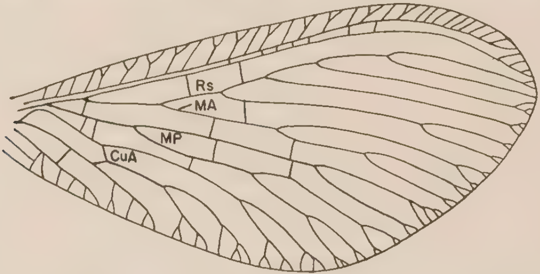


Figure 1. *Nallachius prestoni* (McL.). Drawing of fore wing of the type (♂) in the British Museum (made by D. E. Kimmins). Lettering (original): Rs, radial sector; MA, anterior media; MP, posterior media; CuA, anterior cubitus.

The male genital structures show only slight differences in the several known species of the genus. In all probability they will not be as useful in specific taxonomy as venational details.

Nallachius prestoni (McLachlan)

Figure 1

Dilar prestoni McLachlan, 1880, Ent. Mon. Mag., 17: 39.
Nallachius prestoni Navas, 1909, Real. Acad. Ciénc. Art. Barcelona, 7(17): 667.

I have seen no specimens of this insect, but include here a drawing of the fore wing made from the type (♂, Rio de Janeiro, Brazil) by Mr. D. E. Kimmins, of the British Museum (Natural History). Photographs of the wings of *prestoni* are reproduced in Professor Da Costa Lima's *Insectos do Brasil,* tome 4 (1943), figures 54 and 55. As shown in figure 1, there are seven short cross-veins in the subcostal space, and five main branches of the radial sector (not including MA). The posterior branch of MP is not anastomosed with CuA. Mr. Kimmins also kindly sent me a drawing of the terminal abdominal structures, which closely resemble those of *N. americanus* (Carpenter, 1940, fig. 74).

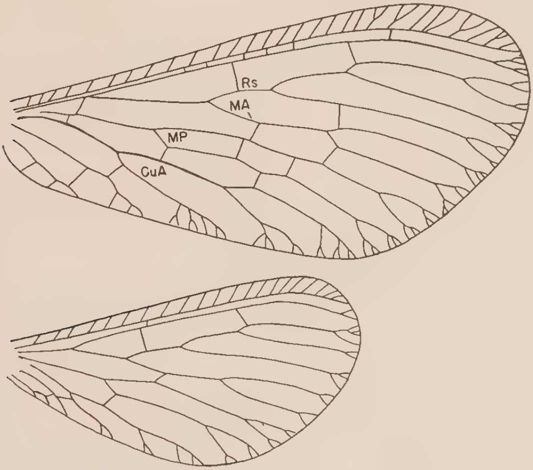


Figure 2. *Nallachius pulchellus* (Banks). Drawing of fore and hind wings of type (♂) in the Museum of Comparative Zoölogy.

Nallachius pulchellus (Banks)

Figure 2

Dilar (*Nallachius*) *pulchellus* Banks, 1938, Rev. de Ent., 9: 289.

Nallachius pulchellus Carpenter, 1940, Proc. Amer. Acad. Arts Sci., 74: 274.

I include here a drawing of the fore and hind wings of the male. The venation is much more open than that of *prestoni*, there being only three main branches to Rs, and less secondary branching of all veins. The posterior branch of MP is independent of CuA, as in *prestoni*. Most of the costal veinlets are unbranched, but this is probably variable in individuals. The male genital armature is surprisingly like that of *prestoni*, though the ædeagus is relatively longer (Carpenter, 1940, fig. 75c).

The types (♂♀) of *pulchellus* were collected at Soledad (Cienfuegos), Cuba, May 4, 1930, and an additional male was recorded by me in 1940 from the Santa Rita Mountains (5000–8000 ft.), Arizona.

Nallachius bruchi Navas

Nallachius bruchi Navas, 1923, Arix. l'Inst. Ciénc. Barcelona, 7: 195.

This species is known only by the female type, from Alta Gracia (Cordoba), Argentina, and originally deposited in the Navas collection. Navas did not figure the wings and I doubt that the species can be recognized from his description. However, it is clear from his account that the posterior media ("procubito") is not anastomosed with CuA.

Nallachius reductus, n. sp.

Figure 3

Male: antennæ very pale yellow and with long pectinations as characteristic of the genus; eyes very dark brown or even black; head and prothorax light brown; legs pale yellow, with dark brown at distal end of tibia. Fore wing: length, 5 mm.; greatest width, 2.2 mm.; relatively more slender than that of *prestoni,* and its hind margin less rounded; membrane hyaline, with numerous faint and irregular gray spots; only a few costal veinlets forked; end of Sc and R1 not so strongly curved as in *prestoni;* Rs (of type) with four main branches; media, cubitus and cross-veins as in *prestoni,* there being no anastomosis between the posterior branch of MP and CuA. Hind wing: length, 3 mm.; width, 2 mm.; broadly oval; costal area relatively broad; Rs (in type) with three main

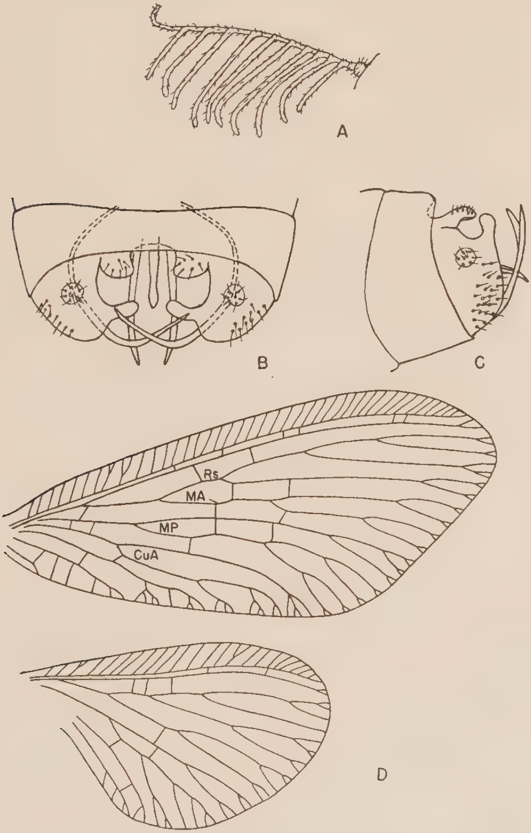


Figure 3. *Nallachius reductus,* n. sp. A, antenna; B, terminal part of abdomen, dorsal view; C, same, lateral view; D, fore and hind wings. All drawings made from the type (♂) in the Museum of Comparative Zoölogy.

branches. Genital armature as shown in figure 3, B, C; ædeagus longer than in *prestoni.*

Female unknown.

Holotype (♂): No. 27664, Museum of Comparative Zoölogy; collected at Ualyaia, Paraguay; October (F. Schade).

This species has much fainter wing markings than *prestoni,* the wing as a whole appearing smoky. The 10th abdominal segment has more pronounced lobes than in *prestoni,* and the ædeagus is shorter. The hind wing is much more reduced than that of *prestoni.*

Nallachius americanus McL.

Figure 4

Dilar americana McLachlan, 1881, Ent. Mon. Mag., 18: 55; Banks, 1905, Trans. Amer. Ent. Soc., 32: 24.

Nallachius americanus Navas, 1909, Mem. Real. Acad. Ciénc. Art. Barcelona, 7(17): 667; Carpenter, 1940, Proc. Amer. Acad. Arts. Sci., 74: 273; Steyskal, 1944, Psyche, 51: 183.

The male genital armature and wings of both sexes were figured in my 1940 revision, but I include here drawings of the wings of the male in order to call attention to the anastomosis of the posterior branch of MP with CuA in the fore wing. The amount of anastomosis appears to be constant in the species. So far as I am aware, this venational peculiarity is unknown in the Old World Dilarids, though it does exist in *N. loxanus* Navas, from Ecuador. If it were not for the striking similarity of the male genitalia of *americanus* and *prestoni,* I would consider this sufficient to separate the two generically. It is noteworthy, also, that there are fewer subcostal cross-veins in *americanus* than in *prestoni.*

The surprising collection of twenty-seven specimens of *americanus* in Detroit, Michigan, has already been noted by Steyskal (1944). The species is now known to occur in Kentucky (type), Maryland, Virginia, and Michigan.[2] In the Museum of Comparative Zoölogy there is also a male from El Yunque, c. 3000 ft., Puerto Rico, May, 1931 (P. J. Darlington). This is an unexpected extension of the range, but careful study of the specimen, including the genitalia, fails to show any differences of a specific nature.

---

[2] But not California, as stated by Navas (Gen. Insectorum, 156: 1; 1914).

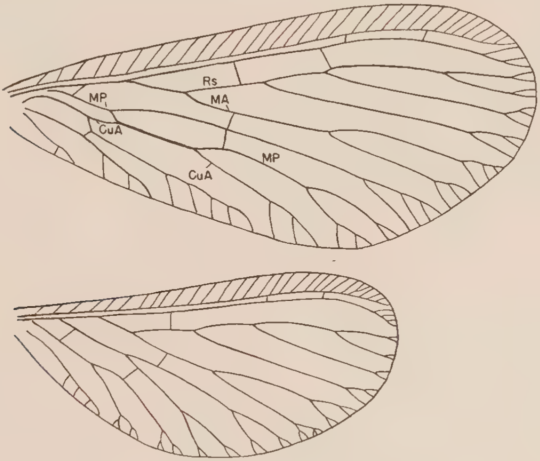


Figure 4. *Nallachius americanus* (McL.). Drawing of fore and hind wings of a male, collected at Detroit, Michigan, June 28, 1944 (Geo. Steyskal), and now in the Museum of Comparative Zoölogy.

Nallachius loxanus Navas

Nallachius loxanus Navas, 1911, Ann. Soc. Sci. Bruxelles, 25: 219.

This is known only from the male type, which was collected at Loja, Ecuador, in 1909, and is now in the Muséum National in Paris. Navas' crudely drawn figure of the wings shows that the posterior branch of the anterior media is anastomosed with the anterior cubitus, as in *americanus,* although the amount of anastomosis is not indicated. According to his drawing, the hind wing is much more slender than that of *americanus.*

Neodilar, new genus

Probably more closely allied to *Dilar* than to *Nallachius.* *Female:* Body structure essentially as in *Dilar* as far as known.[3] Fore wing: short and triangular; venation much as in *Dilar,* the veins with many secondary branches, but with very few cross-veins, and a short anastomosis of the posterior branch of MP and CuA. Hind wing: short and very broad; costal space also very wide. Male unknown.

Genotype: *Dilar hermosa* Banks.

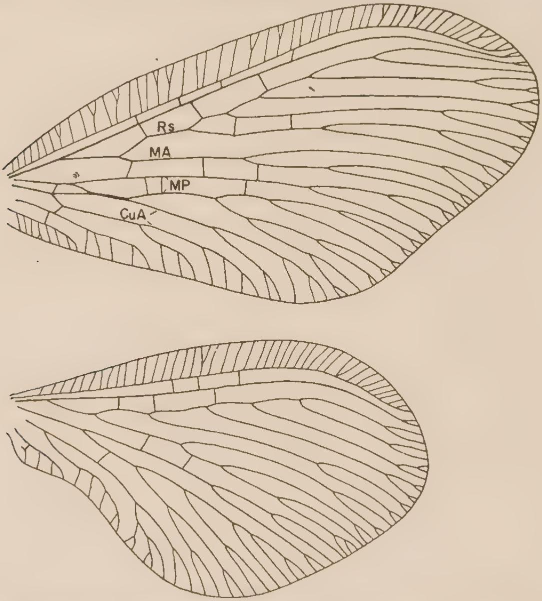


Figure 5. *Neodilar hermosa* (Banks). Drawing of fore and hind wings of the type (♀), in the Museum of Comparative Zoölogy.

Neodilar hermosa (Banks)

Figure 5

Dilar (*Nallachius*) *hermosa* Banks, 1913, Trans. Amer. Ent. Soc. 39: 220.

Banks has given a complete description of this insect, but I include here drawings of the fore and hind wings, which have not previously been illustrated. They show a combination of certain characteristics of *Dilar* and *Nallachius*. The maculations on the wings resemble those of

---

[3] The antennæ are broken off in the type of *hermosa*.

N. prestoni in size, being larger than the ones occurring in *Dilar*. The triangular fore wing, short hind wing, the small number of cross-veins and the anastomosis of MP3+4 and CuA are also suggestive of *Nallachius*. On the other hand, the relatively large size (wing expanse, 25 mm.), and especially the very extensive secondary branching of the veins are suggestive of *Dilar*. The latter characteristic is probably the most significant of these, and until the male is found, we may assume the closest affinities are with the Old World Dilarids.

The female type (which is in the Museum of Comparative Zoölogy) is the only specimen of this insect known to me; it was collected at Pacho, E. Cordilleras, Colombia, elevation 6600 ft.

ON SOME ACARINA FROM NORTH CAROLINA[1]

By Nathan Banks
Holliston, Mass.

Among a considerable number of mites collected by Prof. A. S. Pearse at Durham, North Carolina, are some new species and other rare or little known forms. Of particular interest is the rediscovery of Say's *Erythræus mamillatus,* which proves to belong to the genus Labidistomma, not previously recognized in the eastern part of our country. The genus Xenillus, hitherto not noted from America is also of interest; it was described many years ago as a new genus of beetles. The highly specialized group of Gymnodamæini is represented by four species, in three genera, two of which are new. A specimen of the peculiar *Zetorchestes equestris,* described by Berlese from Missouri, is the first in an American collection.

ERYTHRÆIDÆ

Erythræus exilipes sp. nov.

Figs. 30, 35

Body nearly two and one-fourth times as long as broad, broadest just above third coxæ, a little before middle of length, front margin nearly straight across, two eyes each side, about diameter apart, median groove about one-half as long as front margin. Body covered with stout, sharp-pointed spines, rather long, and mostly erect; many, when magnified, are seen to be covered with minute sharp spicules. Legs also with bristles, those on coxæ about as coarse as on body, but beyond becoming finer, and mostly appressed, those on the under side of the last joint of front legs very fine and short.

Legs long and slender, all tarsi swollen. Front legs nearly twice as long as body, the third joint from tip (tibia) about as long as greatest width of body, tarsus about two-thirds of protarsus; second pair of legs but little longer than body; the tarsus about three-fourths of

---

[1] Published with a grant from the Museum of Comparative Zoölogy at Harvard College.

protarsus; third legs plainly longer than second pair, tarsus about two-thirds of the slender protarsus; fourth legs fully two and one-half times as long as body, and very slender, the femora and tibia about equal in length, and each longer than width of body, the protarsus still longer, the tarsus not one-half of protarsus.

Palpi of moderate length, the third joint swollen, the sides convex, the fifth with stout, apical claw, the lower edge showing about five small, short teeth; the thumb strongly clavate, reaching beyond claw, and with many stiff bristles.

Length of body 1.8 mm.

One from litter in Duke Forest, Durham, N. Car., 7 July (Pearse). Several young ones, of possibly the same species, taken at same place in July and August; these have very tenuous long legs.

The length of the legs, and proportions of the joints thereof will separate the species from allied forms with such long hind legs. Type M.C.Z. Arachn. 3022.

Erythræus carolinus sp. nov.

Figs. 1, 11

Body reddish, legs pale; body fully two-thirds as broad as long, broadly rounded; above with many erect, stiff, simple bristles, as broad at tip as at base, each about twice as long as the width of a femur.

Palpi not one-half the length of front tibia; all legs long and very slender, tarsi enlarged; front femora as as broad as body at third coxæ, the second pair a little longer than body, first pair more than twice the length of body; femur two about one-half of femur one; last joint of front legs considerably enlarged, broadest before tip, more than one-third the length of front tibia. Last joint of second and third legs not as much enlarged. Some of the hairs on legs are bristly on one edge. First and second pairs of legs well separated from the third and fourth.

Front margin of body concave, the corners over the base of front legs projecting slightly, and with three circular pits, and from each a hair, one short and somewhat clavate.

Length 1.4 mm.

One from Duke Univ. Forest, Durham, N. Car., 23 Sept., 1944 (Pearse). Type M.C.Z. Arachn. 3023.

ORIBATIDÆ

Oribàtella carolina sp. nov.

Figs. 2, 8

Pale yellowish, edges of the lamella, edges of the square at base of cephalothorax, and the edges sloping back from each side dark brown; legs pale, almost hyaline. The cephalothorax is nearly as broad at base as long, the line of separation from abdomen crosses just above the square, a fainter line crosses the square. The square is partly open in front to a slender triangle which separates the bases of the broad lamellæ, which, beyond this triangle, appear united into one and extend to near tip of the cephalothorax, where there are two points near each other and each tipped by a short spine, the outer edge of each lamella is dark, at first slightly, evenly outcurved until halfway to the tip of cephalothorax and here the dark margin separates and projects forward in a slender, very sharp spine. Each side, a little lower down, is a lateral plate or lamella, nearly hyaline, about two-thirds the length of cephalothorax, and with a nipple-like tip, this may be the lateral part of the principal lamella, and the dark ridge, ending in a long spine, may be a ridge across the lamella.

Each side of this lower lamella is seen the edge of the tectopedium, this is very long. The submedian bristles are thick, slightly roughened, very long, with a slender pointed tip, and arise from just in front of the clear triangle which separates the lamellæ at base; the superior bristle is a very fine and extremely long hair, arising just in front of each anterior corner of the square; the seta is long, curves forward much as in *O. plummeri*, is thickened only near end which is roughened.

The abdomen is plainly longer than broad, the sides but little curved; the wing does not extend in front of the abdomen, is not very broad, and behind merges gradually into the outline of abdomen. On the venter the genital opening is mostly in front of hind trochanter, bilobed behind, almost as long as broad and fully twice its length in front of the smaller, nearly circular anal opening, which is nearly its length in front of the hind margin of venter.

The legs are very slender and short, with few hairs except on the tarsi.

Length .22 mm.

From the Duke Forest, Durham, North Carolina, 2 Dec. (Pearse). Type M.C.Z. Arachn. 3021.

Alloribates gen. nov.

Goes in the Ceratozetinæ, related to Ceratozetes and Peloribates but differs in the structure of the front tarsi. The anterior border of the abdomen bulges forward over the hind part of the cephalothorax so that the origin of the setæ is plainly behind it. On each side of cephalothorax is a lamella reaching from near base of seta almost to the tip of head, it is rather close to the side margin all the way along, but at tip turns inward. Its highest part is toward the base. The wings are about as in Ceratozetes, the ventral openings are far apart, the setæ are quite long; legs of moderate length to short, the front pair extending in front of head, the femora and tibiæ are rather broad, but not strongly swollen. In the front legs the tibia extends over base of tarsus and ends in a long bristle, the tarsus is not quite as long as the tibia, its tip broadly truncate, and with one claw; on the upper side before tip of tarsus there is a cusp bearing a stout, curved bristle.

Alloribates singularis sp. nov.

Figs. 24, 25

Dull yellowish brown, legs paler. Abdomen nearly twice as long as broad, the sides in middle nearly parallel. Cephalothorax very short in middle, near each side margin is the long lamella, no visible hair at tip; setæ hardly as long as their distance apart, the tip fusiform, moderately swollen, and slightly scabrous; just in front of the suture are the two short, superior bristles, not far apart.

No hairs on abdomen; wings several times longer than broad, their lower edge (seen from below) rolled toward body. Genital opening small, twice its length in front of the much larger anal opening.

Legs short and fairly stout, upper side of second coxal bar reaching the genital opening, other bars shorter, and hind border of hind coxæ scarcely noticeable. Femora and tibiæ stout, but sides little rounded, tarsi tapering, except in front leg where it is broadly truncate, with a cusp on its upper side, bearing a curved stout bristle.

Length of body .36 to .42 mm.

Several specimens from Duke Forest, Durham, N. Car., numbers 475, 385, 238, 514, and March–April. Type M.C.Z. Arachn. 3020.

Minunthozetes angusta sp. nov.

Figs. 37, 38

This is a more narrow species than the European type of the genus. The cephalothorax is about one-half as long as the abdomen; the lamella is a low, even, ridge arising close to the base of the seta and sloping forward to its fellow, not far behind the tip of head, the two lamellæ connected by a short translamella, similar to the lamella; apparently there is no hair at tip of lamella, nor noticeable superior bristles; on each side near side-margin is a short straight ridge, the lateral lamella. The seta is short, not reaching laterally beyond the legs, the basal two thirds slender and curved back, the apical third swollen, fusiform, and almost pointed at tip.

The abdomen is nearly one and one-half times as long as broad, for some distance the sides nearly parallel, broadly rounded behind, no hairs, the wings long and slender, base truncate, seen from below, the edge is inrolled for nearly one-half of length.

Legs rather slender, but not long, front tarsus simple, one claw; tibia with a long apical bristle, its tip extending slightly over tarsus, femora somewhat thicker, hind femora short and thick, truncate at tip, the patella attached to upper tip. Genital opening a little broader in front than long, about one and one-half its length in front of the much larger anal opening, latter wider behind than in front, which is slightly bilobed, borders of coxæ three distinct, but no evident hind border to hind coxæ.

Length .3 mm.

From Duke Forest, Durham, N. Carolina (Pearse), numbers 475, 433, and 238. Type M.C.Z. Arachn. 3019.

Tribe ORIBATINI

This tribe, which includes typical Oribata (Damæus), Belba, etc., may be divided into two sections, those with the front tibia normal (Oribata, Belba, etc.) and those in which the front tibiæ are extended over the base of the tarsus, and the tarsus shortened. In this collection are three genera which belong to this second section; they can be tabulated as below.

1. Abdomen about as broad as long, sides rounded; tectopedia not behind but beneath second trochanters; legs not slender, most joints without any swollen part; rather broad, patella narrow on short apical part, sides of tibiæ parallel; the claws borne on a stalk to tarsus .... *Allodamæus*

   Tibiæ narrowed at base, patellae with parallel sides; abdomen broader than long, claws not on a long stalk; tectopedia behind second trochanters just as behind first trochanters 2

2. Sides of abdomen nearly parallel, legs very long and slender, much longer than entire body; ventral openings united, borders of second and third coxæ nearly reaching middle of venter .... *Gymnodamæus*

   Sides of body convex, legs scarcely as long as body; ventral openings well separated, borders of second and third coxæ not reaching half-way to middle of venter .... *Jacotella*

Jacotella gen. nov.

This is based on a small, short-legged species described as *Gymnodamæus quadricaudiculus*[1] by Jacot. Instead of the extremely long and tenuous legs of the typical Gymnodamæus the legs are scarcely longer than body, and not especially slender; the ventral apertures are well separated; there is a strong tectopedum behind first and second trochanters.

---

[1] Jour. N. Y. Ent. Soc., 45: 356, 1937.

Jacotella quadricaudicula Jacot

Figs. 3, 15

One from Duke Forest, Durham, N. Car., 25 Nov. (Pearse). It was described mostly in comparison with a European species, *Gymnodamæus austriacus,* so I have given figures (3 and 15) of the venter and legs.

Gymnodamæus Kulczynski

Ewing, in 1917,[2] erected a new genus, Heterodamæus, and included in it his *Damæus magnisetosus;*[3] but unfortunately Ewing selected as genotype the European *Damæus bicostatus* Koch, a species which Kulczynski, some fifteen years before, had selected as type of Gymnodamæus. Thus Heterodamæus becomes a synonym of Gymnodomæus. Jacot[4] says that Kulczynski[5] assigned no type; however he is entirely wrong, for on page 43 of Kulczynski's paper is the statement "Typus *Gymnodamæus bicostatus* Koch."

Gymnodamæus pearsei sp. nov.

Figs. 16, 27

Dark reddish brown, border of abdomen appears black. Shape of body as in genotype, *bicostatus,* plainly longer than broad, not narrowed behind. Two tiny hairs near tip of head, and a longer one each side a little further back. Setæ about as long as the space separating them, swollen toward tip, but the tip sharp. Legs extremely slender and very long, as in the long-legged Oribata. The front and hind femora have rather long basal stalk, then suddenly much enlarged, then tapering to the long slender apical part, this apical part is longer in front femora than in the hind pair; patella one about one-third of tibia, both no wider than the slender part of femora, except in the front pair where the apex of tibia is broadened where it overhangs the base of tarsus; each joint with two long hairs in usual plan; trochanter of hind legs long and but slightly swollen, that of third legs much swollen and short, the femora with a short stalk before the swollen part, thence equally slender to the tarsi which are a little more swollen on basal part. The ventral apertures are on apical half of venter and united, the genital a little the longer; there is a dark transverse line in front of the genital opening, and from each end a faint line curves out to the margin, on each side, opposite the genital opening, is a curved dark mark; the hind borders of second and third coxæ almost reach the middle.

---

[2] Ann. Ent. Soc. Amer., 10: 123, 1917.

[3] *Ibid.,* 129.

[4] Bull. 121, B. P. Bishop Mus., p. 18, 1934.

[5] Acad. Litter. Cracoviensis, 42, Ser. B; 43, 1902.

Length of body .5 mm., of hind leg .9 mm.

Several specimens from Duke University at Durham, North Carolina, 1 Sept., 14 Oct., 25 Nov., 10, 24 Febr., and 21 April (Pearse). Type M.C.Z. Arachn. 3012.

This species is separated from Ewing's *Damæus magnisetosus,* by the very much longer front tibia and the longer hind femur; *magnisetosus* moreover has a nearly circular venter, the legs are broader, the granulations coarser, the tarsi more slender at base.

Gymnodamæus minor sp. nov.

Figs. 28, 39

The color is yellowish; about two-thirds the size of *G. pearsei;* the body is a little more slender, and the legs are not quite so long. The cephalothorax is similar but the hair at each side of tip of head is more clavate, the seta is similar, the tip long, fusiform, and scabrous. The first legs are not quite as long as the body, the femora bulbous close to base, before middle faintly sinuous, patella nearly as long as bulb of femur, the tibia becoming broader to the swollen tip, the tarsus attached as in *G. pearsei,* the tarsus is proportionally more swollen than in *pearsei,* hairs similar, but the one at tip of tibia apparently not as long as in *pearsei.* The fourth legs about equal to length of body; the femora are bulbous quite close to base, so that the stalk of femur is extremely short (much longer in *pearsei*). The tarsus is fusiform, quite hairy toward tip. On the venter the apertures are separated slightly more than in *pearsei,* but connected by a dark, chitinous area; the outlines of coxæ are not visible, only at margin is a dark circle at base of leg three and four. Coxæ one and two are separated by an oblique bar, not reaching one-half way to middle, at tip of abdomen are three hairs each side, all short, but one is much longer than others, and curved almost in a circle.

Length .35 mm.

From Duke Forest, Durham, North Carolina, in January, March and April, numbers 238, and 505. Type M.C.Z. Arachn. 3013.

Readily separated by the very short stalk to the hind femora, as well as size, color, apical hairs of abdomen, etc.; also separated from *Damæus magnisetosus* Ewing, by the more slender and less coarsely granulose legs; the front tibia is similar in length to that species, but the tarsus is narrow at base and swollen in middle; the abdomen of *magnisetosus* is much broader, nearly circular, the hind femur of Ewing's species has the hind femur swollen in middle with a short stalk at each end.

Allodamæus gen. nov.

In appearance this resembles a Belba, but the second tectopedia are present, but bent under the second trochanters and so not noticeable from above. The abdomen is as broad as long, broadly rounded, the ventral openings are separated by a short space. The legs are of moderate length, much as in Belba; in the front legs the tip of the tibia extends over the base of tarsus much as in Gymnodamæus, but more broadly. The tarsus, instead of gradually tapering to a fine point, is abruptly narrowed some distance before tip, thus the claws are attached to a long, slender stalk that has the appearance of a separate joint. The legs, of moderate length, are not especially slender, nor scarcely swollen on any joints, except the trochanter (like Ewing's figure of *Damæus magnisetosus*). However in essential characters it belongs in the Oribatini, near to Gymnodamæus.

Type is *Allodamæus ewingi* n. sp.

The nymph of this or some allied species has two long, curved setæ at tip of abdomen (figure 6).

Allodamæus ewingi sp. nov.

Reddish brown to dull yellowish brown; there is a pulverulence over the legs which has the appearance of equally short erect hairs on each side of each joint; it is also over the front of head. The fine hairs on the legs are, at first, scarcely noticeable, a much stouter hair arises from near tip of third trochanter. The tectopedium behind first trochanter has a tooth on outer side. The ventral openings are but little separated, the anal slightly the longer, the genital almost its length from the transverse bar at base of abdomen, the anal opening is nearly one-half its length from the end of venter. Above on the cephalothorax at each basal corner is the base of the seta, but no seta is visible unless it is very short and capitate; a little in front arises the superior bristle, which near tip is somewhat thickened.

The front legs are nearly as long as width of the abdomen, the hind legs as long as the entire body. The base of the patella and tibia is suddenly broadened, like a basal collar to the joint, the patella is much narrowed beyond the collar, but the tibia continues broad to the attachment of the tarsus, and in front legs the upper tip of tibia is extended in a point over fully one-half of the thick basal part of tarsus, the tip of the tibial projection has a very long hair.

Length .7 mm.

From the forest of Duke Univ., Durham, North Carolina, 1 Sept. (Pearse). Type M.C.Z. Arachn. 3014.

Oribata carolinensis sp. nov.

Figs. 41, 42

Cephalothorax plainly narrowed a little in front of first legs, a curved anterior bristle each side near tip, and one on each side margin near tip, seta fully equal to length of cephalothorax, whip-lash type, the lash very fine and delicate. Abdomen nearly as broad as long, with a row of curved bristles toward each side, six shorter incurved bristles at tip; ventral apertures touch, the genital nearly circular, the anal nearly as long as the genital, but only about two-thirds as broad.

Legs slender, all tarsi long; fourth legs much longer than body, the first legs almost as long as body, the stalk of femur curved and nearly as long as the swollen part, the patella about one-half the tibia, latter (from side) much swollen, fusiform, tarsus with bulb-like swelling near base, the tapering part nearly equal to tibia plus patella. Hind legs with trochanter nearly one-half of femur, latter with stalk nearly one-half of length, swelling fusiform; tibia a little longer than femur, very slender, except a triangular swelling near tip, tarsus little, if any, longer than tarsus of first legs, a swelling near base, tapering to tip. Most of the hairs on legs are slightly curved and minutely pectinate. Second legs much like first, but shorter, third legs much like fourth, but much shorter, the tibia slightly thickened toward tip.

This species is near to *O. longiseta* Bks., but in that species the hind tibia is not nearly as long as tarsus, and latter not so bulbous near base, the hind tarsus plainly longer than front tarsus, the hairs on legs not so plainly pectinate, on abdomen the hairs are short and straight, and on venter the genital aperture is plainly separated from the anal, and not so nearly circular.

Length .55 mm., hind leg .8 mm.

From Duke Forest, Durham, North Carolina, March–April (Pearse coll.). Type M.C.Z. Arachn. 3010.

Oribata diversipes sp. nov.

Figs. 31, 33

Cephalothorax much narrowed in front of first legs, the sides there scarcely curved, just behind head the cephalothorax is much broadened, then narrowed, and then curving outward for second legs, then much narrowed to base; there is a stout, blunt, curved tectopedium behind both first and second legs, stigma about twice its diameter from margin, the seta long, with a fine whip-lash tip; each side of head near tip are two rather long, curved hairs.

Abdomen globose, four short curved hairs at tip, probably some hairs on dorsum, but the dorsum is cracked and rubbed so I see but two bases for hairs. Venter with openings a little separated, but connected by a narrow median ridge, the genital aperture nearly circular the anal more pear-shaped, behind nearly as broad as the genital, but much narrowed in front, broadly separated from the hind border of abdomen.

Legs long, all tarsi long and fine; first legs equal to length of body, femora, tibiæ and base of tarsi swollen about as much as in most species; the second legs a little shorter, the third nearly as long as body, both with distinct swellings though smaller than on first legs, hind legs very much longer than body, fully one and one-half as long, the tibia plus tarsus equal to body, the swellings are very like *angustipes* and that on femur is longer than usual. Most of the hairs on legs are curved, one on tarsus is very long and nearly parallel to tarsus, on the tip of hind tibia is a long, diverging hair with a fine curved tip, much like those of *grossmanni*, and some others. On the second trochanter is a long hair curving forward, a much shorter one on first trochanter.

Length .5 mm.

One from Duke Forest, Durham, N. Car., March–April (Pearse). Type M.C.Z. Arachn. 3009.

Belba inæquipes sp. nov.

Figs. 32, 43

Body and legs pale yellowish. Cephalothorax more than one-half the length of abdomen, latter rather short and broadly rounded behind; no tectopedia behind first legs, a prominent spike-like one behind second legs, also in front and behind base of third legs is a small projection. The seta is long and with a whip-lash tip as in *B. florida*. The abdomen is strongly convex, with a row of bristles on each side, and six shorter ones on hind margin near tip; the venter is nearly circular, the openings are subequal and rather close together. The legs show definite bulbous swellings on femur, tibia and tarsus, all tarsi very slender and long. The front femora have the swollen part but little longer than the curved stalk; the tibia is strongly swollen, with a fairly long stalk, the tarsus also has a distinct thin stalk before the bulb, the part beyond long and tapering. The hind legs are about as long as body, the trochanter very long, nearly or quite as long as the femur, latter swollen in middle, tapering each way to the short stalk, the tibia has a less swollen part at tip, with a stalk more than twice as long, the tarsus has a short stalk before the bulb, a long and very slender part beyond. The third legs have the very long tarsus, but the tibia is only about one-half of tarsus. The legs are not especially hairy, the long hair of front tibia much before tip and scarcely longer than the joint.

Length of body .4 mm.

Two specimens from Duke Forest, North Carolina (Pearse), #238, January, and March–April. Type M.C.Z. Arachn. 3011.

The mite, at first, with very long hind legs resembles *Oribata angustipes*, the front legs, however, are very different, and in the hind legs the femur is much shorter than in *angustipes*.

Oppiella apicalis Jacot

Figs. 14, 17

The specimens from Duke Forest have the tip of cephalothorax more acute than in the typical form. The seta shows a head distinctly longer than in Jacot's fig. 4, with a few short hairs near tip, possibly others toward base. Probably it will be best to consider the subspecies of *O. corrugata* which Jacot describes, *apicalis*, *squarrosa*, the form mentioned by Jacot from Great Falls, Va., and the one figured here as only some of the forms of a variable species, *Oppiella apicalis* (which has precedence).

Autogneta amica Jacot

Figs. 19, 21

One specimen from Duke Forest, Durham, N. Car.

The legs are short and slender; the base of the tarsus is sunk into the concave apex of the tibia in all legs, but most strongly in the front legs where the upper end of tibia extends nearly over the basal half of tarsus and is tipped by a long hair; the slender stalk of the tibia is curved in all legs; all of the tarsi are very hairy on apical half, and the claw is very long; all patellæ are very short, and the tip of femur is lobed on each side.

The cephalothorax is narrowed at base and widest at base of the first tectopedia. A little in front of each basal corner is a large, rounded scar, from its anterior inner corner arises a ridge which curves inward and then extends forward parallel to its fellow for fully three-fourths of length of cephalothorax. From the anterior outer corner of each scar arises the long seta, tipped by an elongate swelling; superior bristles apparently lacking, but the round insertion is seen opposite the turn of the ridge.

The abdomen, not twice the length of the cephalothorax, is broadest behind the middle. On the venter is a strong division and constriction between the cephalothorax and the abdomen, there is but little indication of coxal limits, but the second (apparently) is a broad plate separated from its fellow by a somewhat triangular outline, a faint curved line crosses just in front of genital opening and slopes backward to indicate hind border of the fourth coxa.

The genital aperture is broader in front than behind, the anal opening much larger, and fully one and one-half its length from the genital opening. *Dolicheremæus rubripes* Jacot, Florida Entom., 1938, is very similar in general appearance to this species, the body is more slender.

Carabodoides retracta sp. nov.

Figs. 9, 29

Cephalothorax fully as broad at base as long, abdomen about one and a third times as long as broad, broadly rounded behind. Seta spatulate, the broadened tip flat, with rounded outer tip. The cephalothorax above has irregular low, narrow ridges, one starts from close to the stigma, extending obliquely forward and inward, then turns to run parallel to outer margin of cephalothorax.

The legs are short and stout the femora especially thick. In the front legs the tibia is cup-shaped, its tip nearly as broad as its length, this tip is concave and the basal part of tarsus is retracted within it, the tip of tibia above has a long hair. The short tarsus is suddenly narrowed from above and here there are a few hairs. In the hind legs the femora are broad, shouldered, subtriangular, the hind tarsus about equal to tibia, its tip scarcely reaching tip of abdomen. The front legs are hardly as long as width of abdomen.

The genital aperture almost touches the anal, is broader in front than the anal, but behind is a little more narrow than anal, latter is fully as long as genital, but quite narrow in front and fully twice as broad behind.

Length .55 to .6 mm.

From Duke Forest, N. Carolina, numbers 475, 238. The front tibia is more modified than in *apicalis* or *sacchariomycetoides.* Type M.C.Z. Arachn. 3018.

Eremobelba gracilior Berlese(?)

Figs. 10, 23

Related to *E. flagellaris,* smaller, abdomen more elongate. Cephalothorax with two fine linear carinæ in middle, at first parallel, then each turns outward, stigma close to base, hardly its diameter from outer margin; seta long, slender, ending in a fine whip-lash. Above the base of leg one is a shorter carina, reaching forward of lateral margin.

Abdomen nearly one and one-third as long as broad; the anterior lateral margin appears heavier (as in Berlese's figure) with hairs about as in figure but not all distinct in this specimen; four on hind margin, and a submarginal row, and an apparent oblique row.

On the venter the triple U-suture across base of the camerostome and ending at tectopedial spines is very distinct. The genital aperture is a little longer than broad, hardly one-third its length in front of the larger anal aperture, which is broader behind, and separated from hind margin almost as far as from genital aperture.

The legs are finely granular and more slender than in *flagellaris,* especially the tarsi beyond the swelling; the bulb at tip of front tibia is plainly a little broader than long, and almost touches the swelling on base of tarsus; the hind femora are plainly pedicellate, and all patellæ are quite long; the tarsi are very hairy.

Length .4 mm.

From the Duke Univ. Forest, Durham, N. Car., numbers 238, 487.

From the fourteen words of description of Berlese it is hardly possible to recognize this species, but the figure agrees in several particulars. However, the most characteristic points in the legs are not given, since the legs were not figured. His figure shows a long simple seta, but it is possible that the whip-lash tip was lost.

Zetorchestes equestris Berl.
Fig. 26

One specimen from Duke Forest; it is apparently rare; I had never seen it, and none in the Jacot collection.

The body is broadly rounded except in front, where it comes to a point. The first three coxæ are close together in front, the hind coxæ situated much further back. Hind legs much longer and stouter than the others, with a spine at tip of tibia, and two on outer edge of tarsus. Ventral openings connected by borders, the anal much the larger, broadest toward rear, genital not nearly so long and about two-thirds as broad, more than its length behind the third coxæ. Tarsi of front legs rather slender, nearly twice as long as tibia. Above the cephalothorax has a lateral dark lamella on outer side, two-thirds of length of cephalothorax. The seta is paddle-shaped, a slender stalk and a large flat ovoid tip, somewhat lined and with numerous minute points.

Length .4 mm.

Xenillus occultus sp. nov.
Figs. 5, 7

Dull brownish rufous; surface very minutely roughened; body about two-thirds as broad as long, broadly rounded behind, and there with a few erect hairs, each with the tip slightly enlarged, four each side projecting beyond abdomen, and three or four others each side toward tip. Cephalothorax with two elongate, incurved plates (fig. 7), broadest before tip where they almost meet, tip broad, concave, the outer point more prominent, each plate bears a long, roughened, stout bristle from middle of the tip; tip of head with a short, curved bristle each side; at base of the cephalothorax a fairly broad transverse area is delimited and from each upper corner arises the subbasal bristle, enlarged at tip; each seta is nearly as long as this bristle, clavate at tip; each first tectopedium is enlarged and projects laterally, with a sharp outer point anteriorly.

Legs slender, fairly short, joints but little swollen, three equal claws; first legs about length of body, patella nearly one-half of tibia, but few hairs, a long one at tip of tibia above, one, nearly as long, from tarsus before middle, elsewhere but few short hairs; second and third legs hardly width of body; the fourth legs scarcely reach the tip of body.

On the under side are three parallel cross-bars; one at base of first coxæ, one at base of second coxæ, the third, more curved passing behind third coxæ and reaching nearly to fourth coxæ; in the middle this cross-bar is confluent with the curved bar from fourth coxæ, which touches almost the half of genital aperture; the latter is a little longer than broad, scarcely truncate behind.

The anal aperture is twice as long as the genital and situate about one and one-fourth its length behind the genital aperture in the female, fully one and one-half its length behind in the male.

Length of female .7 mm., of male .55 mm.

Two specimens from the Duke Forest, North Carolina. Type M.C.Z. Arachn. 3024.

Eremæus politus sp. nov.

Figs. 20, 22

Pale yellowish. Cephalothorax plainly longer than broad, narowed in front of first legs, in middle with two slightly curved and parallel carinæ; first legs far in front of second, the stigma more than its width from side, behind is a transverse ridge, narrow through the middle, widened behind and beyond stigma, setæ longer than distance between their bases, the head long, and slender, scabrous. A tectopedium behind coxæ one, and also two, the latter rather complicated.

Abdomen fully one and one-half times as long as broad, sides but slightly convex; on each side of the basal part is a short strip of granules. The genital opening plainly longer than broad, about its length in front of the larger anal opening, latter narrow and faintly bilobed in front, more than twice as broad behind. The fourth pair of legs considerably behind the third; the side of the venter between these two pairs is convex, the hind coxæ occupying most of the area, and strongly curved behind. Legs short and stout, with but few fine hairs, almost wholly on tarsi, three claws; all femora thickened, front ones strongly so, and with a ridge or lamella below, tibia short, little if any longer than tarsus, front tarsus from side slightly swollen; hind legs reach nearly to tip of abdomen.

Length of body .4 mm.

From Duke Forest, N. Car., numbers 475, 433, 514. Type M.C.Z. Arachn. 3017.

Epilohmannia elongata sp. nov.

Fig. 40

Pale yellowish brown, legs almost colorless. Body slender as usual, somewhat broadened in middle of abdomen; above without evident hairs; seta short, with clavate tip. The head in front is almost in a point; tip of abdomen broadly rounded. Front legs a little heavier than the others, tarsi quite thick and with a number of rather short hairs, one claw; tibia very broad, rounded on each side, a long hair a little before tip; the third joint before tip (patella?) longer than other joints, narrow on base, but much broadened before tip, scarcely as broad as tibia, second and third legs shorter, about as long as the greatest width of abdomen, the second, third, and fourth joints narrowed on base; fourth leg much longer, reaching to tip of abdomen; first visible joint (trochanter?) very long and extended on outer side at tip over base of next joint, next three joints subequal, narrowed on base, tarsus slender and longer than the preceding joint, all tarsi with a few hairs, the claw very large. Hind coxæ much broadened toward tip, together showing a deep median excavation behind.

The genital opening is situate the length of its base from the base of this excavation; it is roundly broadened behind to a width equal to its length, and here there is a line reaching almost across venter, and crossed by a sloping longitudinal line extending back to middle of anal opening. Anal opening not quite half its width behind the genital, its sides rounded, and slightly narrowed behind, its length plainly a little less than the genital opening. Surface of venter around genital opening shows numerous well-separated granules, and also many down the middle of genital covers, the margins free of them. The second coxæ are very broad, the third much narrower, especially on base; the first coxæ are triangular, the pointed base not reaching middle.

Length .35 mm.

One from the Duke Univ. Forest, Durham, N. Car., 21 Oct. (Pearse). Type M.C.Z. Arachn. 3016.

Lohmannia brevipes sp. nov.

Figs. 34, 36

Body a little more than twice as long as broad, sides of abdomen nearly parallel, tip broadly rounded, tip of head rounded, a fine hair each side; the superior bristles are barbed, and situate close to base of seta, latter is a hyaline scale truncate at tip. On each lateral edge of abdomen are six bristles or scale-like hairs, the first four are barbed or roughened bristles, the first bristle near base of abdomen, second about opposite base of genital opening, two others further behind, and nearer together, beyond are two broadened, or scale-like hairs with barbed edges, the last close to tip of abdomen; above on abdomen, not far from margin, is a row of four shorter, also roughened bristles, the first and second close to the first and second marginal bristles. The genital aperture much more narrow than the anal, and a little shorter, its sides nearly parallel, each cover with about nine hairs as in figure; the anal opening connected to the genital, the sides are curved outward, the covers not occupying available space, and each cover with a row of four barbed bristles.

The legs are very short and stout, the front pairs heavier than others, the femora are narrowed at base, and the tibiæ are concave on inner edge, there are some hairs chiefly on tarsus, some on the hind legs are barbed hairs, and also some on outer side of femora one and two are broadened scale-like and roughened; the single claw is very long, the curve mostly near tip; a long hair at tip of tibiæ.

Length .28 mm.

Several specimens from Duke Univ. Forest, Durham, N. Car., 21 Oct., 4, 25, Nov. (Pearse). Type M.C.Z. Arachn. 3015.

LABIDOSTOMMATIDÆ

Labidostomma mamillatus Say (*Erythræus*)

Figs. 4, 12, 18

Say's species has not been recognized previously; Jacot suspected it might belong to Labidostomma, but none had been taken since Say's time. In 1930 I took one in the Smoky Mts. of North Carolina, and Prof. Pearse sends several specimens taken at Duke Forest.

The mandibles above are mostly covered with an arrangement of imbricated rounded scales (castanulate); the jaws are smooth, and slightly outcurved at tip. On the swollen part of mandible not far from base of the jaws is a sloping tubercle, tipped by a long, fine bristle. Each side of the front margin of the body ends in a sharp point, also tipped by a bristle.

A short distance behind the front is a transverse, nearly parallel ridge, most prominent on the sides, between this and the front margin the surface is sculptured as on the mandibles and also in a median raised region behind the ridge, elsewhere the sculpturing is less perfect, tending to be reticulate or granulate. Each side of the median raised area is a fairly prominent clear spot with a hair, possibly corresponding to stigma and seta; a few smaller hairs and bases on front part of body. The side before middle is somewhat swollen, and here are the two "eye spots," facing laterally. The hind one is very large, the one in front much smaller; just in front of the small one arises a long, back-ward directed bristle; two very short hairs at tip of body.

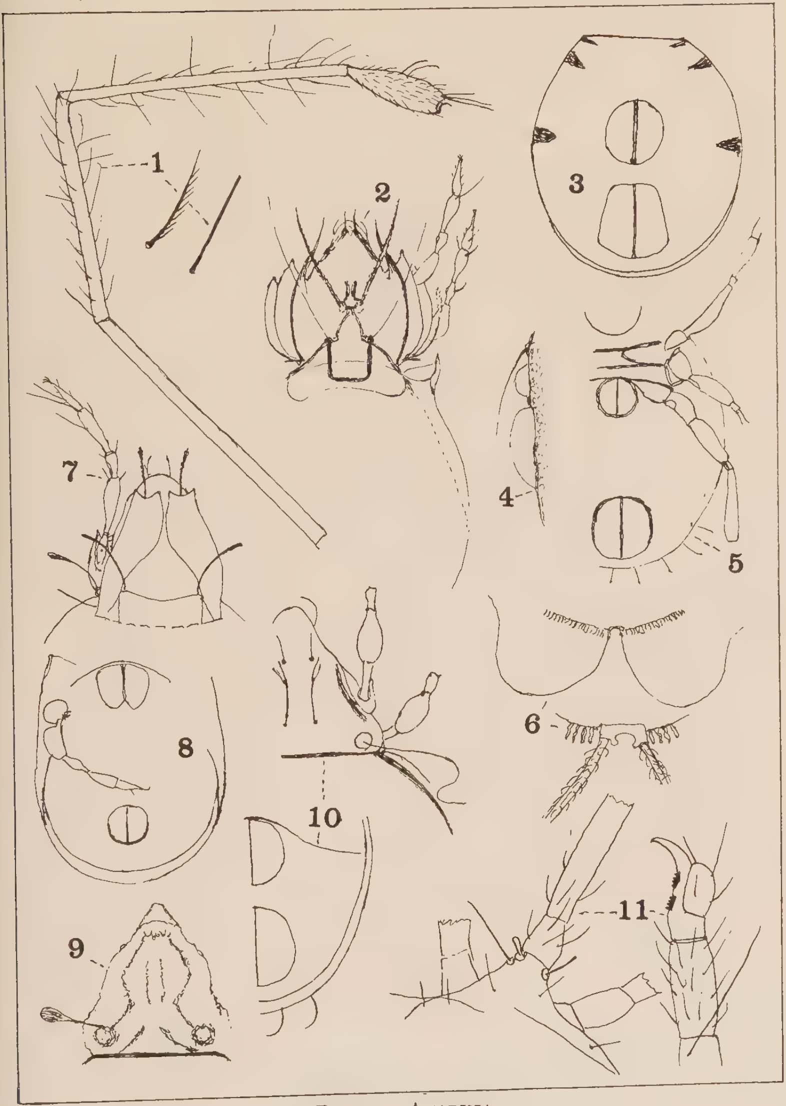
On the venter the coxæ meet in the middle and beyond are six joints, the first and third are quite short (probably trochanter and patella), beyond are two long and the short terminal joint, probably tibia, protarsus and tarsus. The front tarsus ends in two nearly equal claws. The other legs do not have a short patella, the fourth joint from tip being longer than the one beyond it, and the last joint (tarsus) much longer than the penultimate; all legs have fine short hairs, most abundant on the tarsi. The tarsi of the second, third, and fourth pairs end in three claws, the median claw not as much curved as the laterals.

In the female the ventral openings are united in one, which is divided by a transverse line at posterior third, near sides the line curves forward. In the male the two openings are slightly separated, the genital much the larger.

EXPLANATION OF PLATES

PLATE 5

Fig. 1. First leg of *Erythræus carolinus*, and hairs from body.
Fig. 2. *Oribatella carolina*, cephalothorax and base of abdomen from above.
Fig. 3. *Jacotella quadricaudicula*, venter.
Fig. 4. *Labidostomma mamillatus*, "eyes" from above.
Fig. 5. *Xenillus occultus*, venter.
Fig. 6. *Allodamæus ewingi*, tip of abdomen of nymph.
Fig. 7. *Xenillus occultus*, cephalothorax.
Fig. 8. *Oribatella carolina*, venter.
Fig. 9. *Carabodoides retracta*, cephalothorax.
Fig. 10. *Eremobelba gracilior*, cephalothorax, and venter.
Fig. 11. *Erythræus carolinus*, corner of cephalothorax, and palpus.

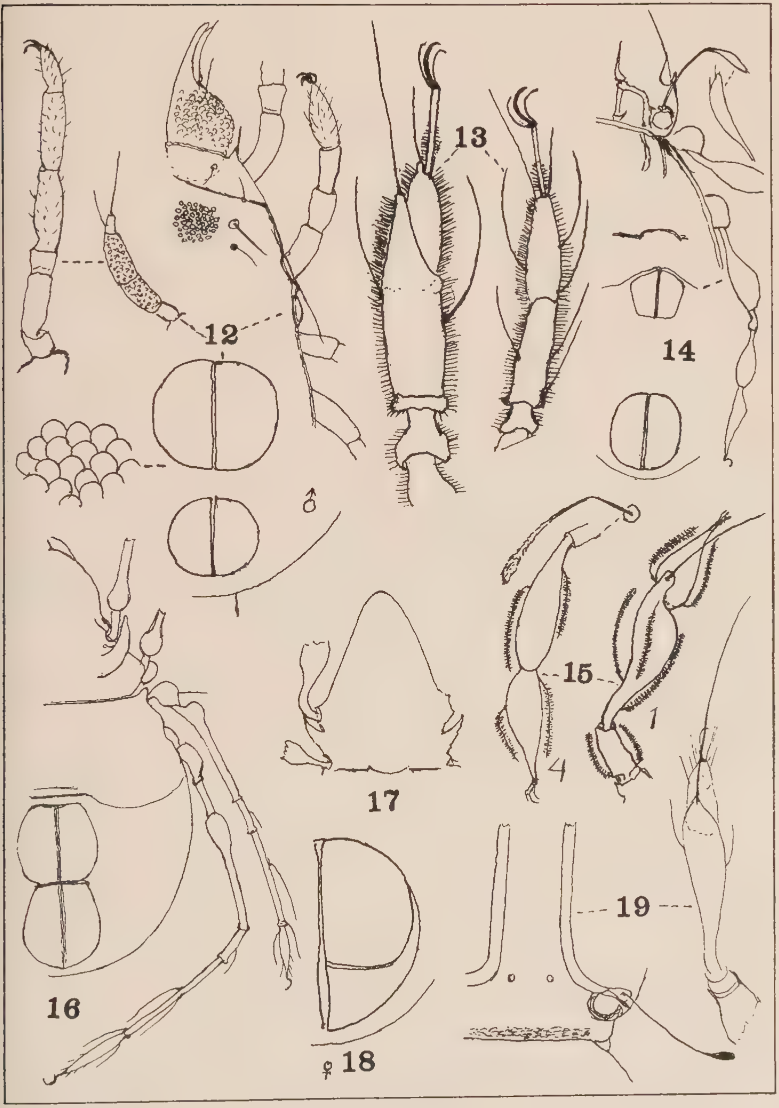


BANKS—ACARINA

PLATE 6

Fig. 12. *Labidostomma mamillatus,* side of cephalothorax; first leg, palpus, ventral apertures of male, and sculpture of mandible.
Fig. 13. *Allodamæus ewingi,* first and second legs.
Fig. 14. *Oppiella apicalis,* side of cephalothorax, and venter.
Fig. 15. *Jacotella quadricaudicula,* seta, and apical part of first and fourth legs.
Fig. 16. *Gymnodamæus pearsei,* under side.
Fig. 17. *Oppiella apicalis,* cephalothorax below.
Fig. 18. *Labididostomma mamillatus,* ventral aperture of female.
Fig. 19. *Autogneta amica,* part of cephalothorax, and front tarsus.

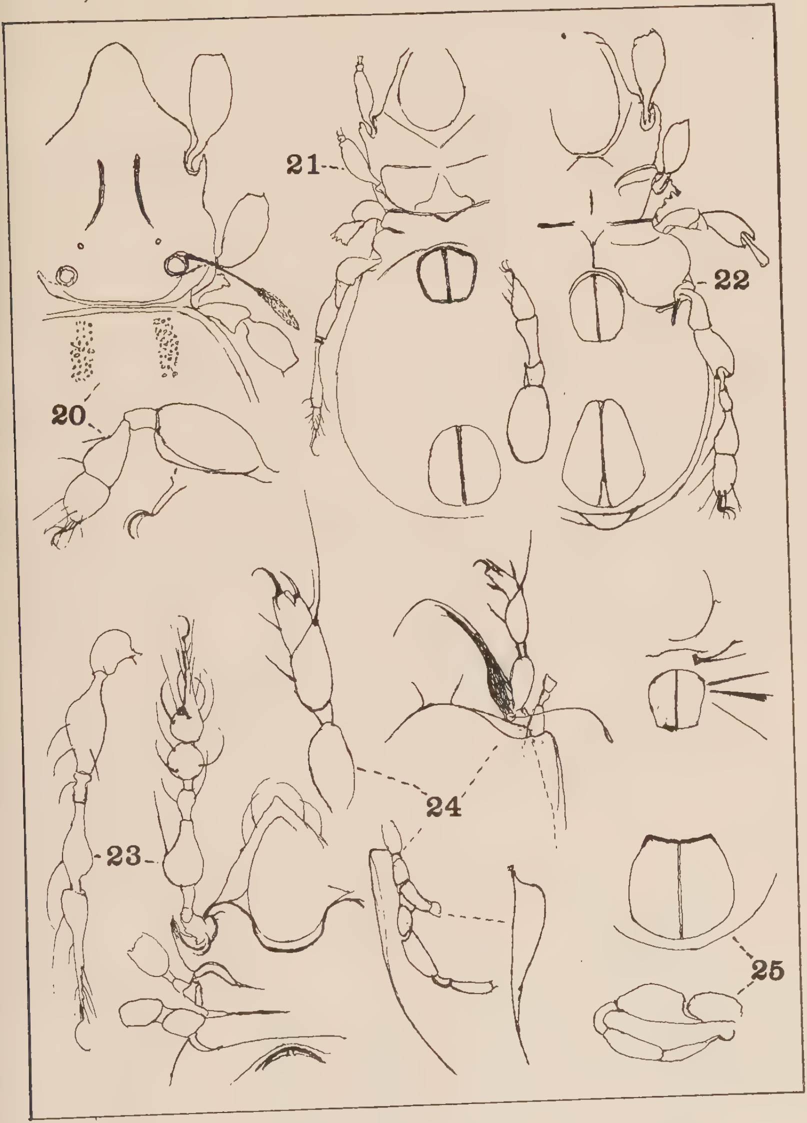
PSYCHE, 1947 VOL. 54, PLATE 6



BANKS—ACARINA

PLATE 7

Fig. 20. *Eremæus politus*, cephalothorax, first leg, and claw.
Fig. 21. *Autogneta amica*, venter.
Fig. 22. *Eremæus politus*, venter, and second leg.
Fig. 23. *Eremobelba gracilior*, cephalothorax from below, and fourth leg.
Fig. 24. *Alloribates singularis*, cephalothorax, wing from side, third and fourth legs, and first tibia and tarsus.
Fig. 25. *Alloribates singularis*, venter, and fourth leg.

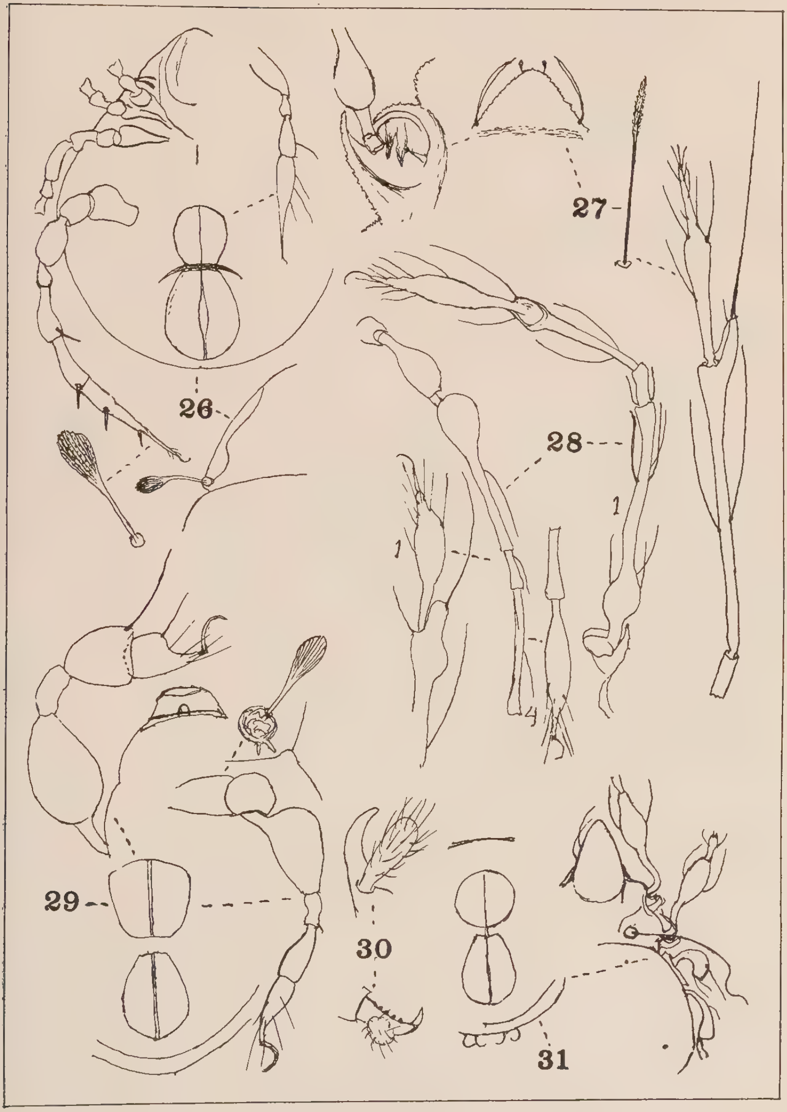


BANKS—ACARINA

PLATE 8

Fig. 26. *Zetorchestes equestris,* venter, edge of cephalothorax, seta, and first leg.
Fig. 27. *Gymnodamæus pearsei,* first tibia and tarsus, seta, tip of cephalothorax, and attachment of first leg.
Fig. 28. *Gymnodamæus minor*, first leg, showing tibia beneath, tibia and tarsus of first leg, showing tibia from side, fourth leg.
Fig. 29. *Carabodoides retracta,* venter, seta, and first leg and edge of cephalothorax.
Fig. 30. *Erythræus exilipes,* palpus from two views.
Fig. 31. *Oribata diversipes,* cephalothorax, and venter.

PSYCHE, 1947 VOL. 54, PLATE 8

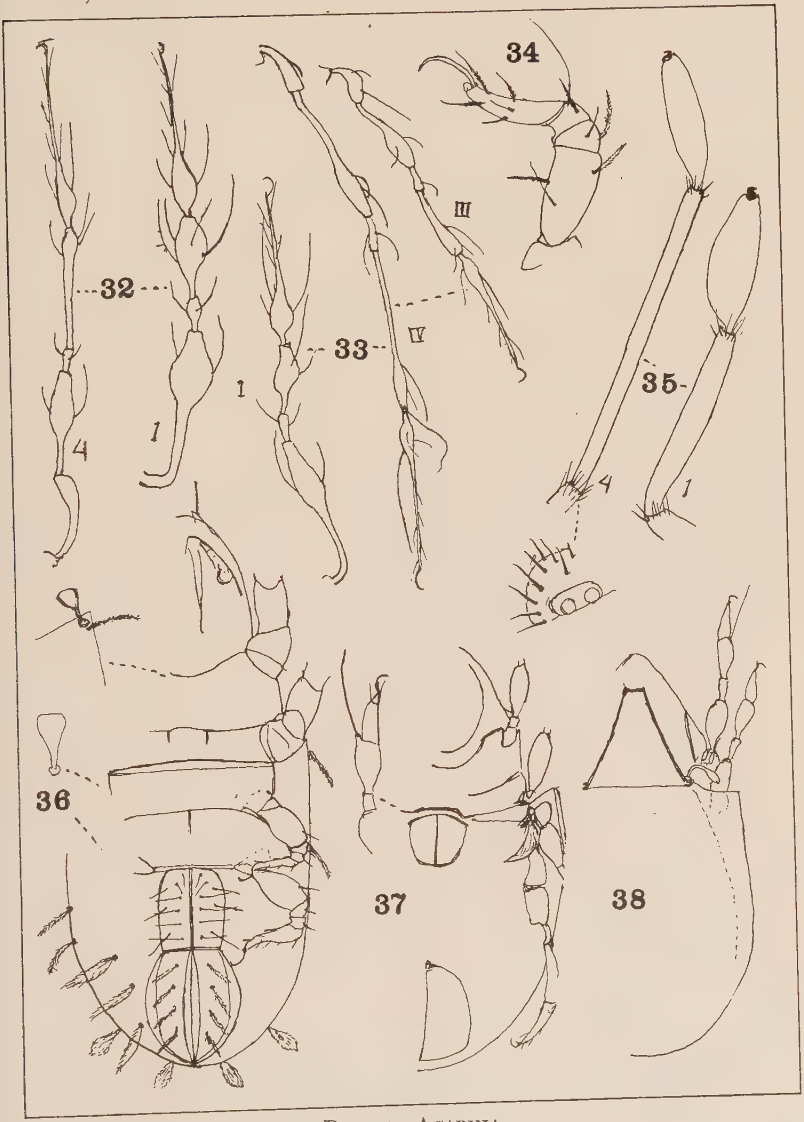


BANKS—ACARINA

Plate 9

Fig. 32. *Belba inæquipes*, first and fourth legs.
Fig. 33. *Oribata diversipes*, first, third, and fourth legs.
Fig. 34. *Lohmannia brevipes*, fourth leg.
Fig. 35. *Erythræus exilipes*, tibia and tarsus of first and fourth legs, eyes.
Fig. 36. *Lohmannia brevipes*, venter, and seta.
Fig. 37. *Minunthozetes angusta*, venter, tibia and tarsus of first leg.
Fig. 38. *Minunthozetes angusta*, dorsum.

Psyche, 1947 Vol. 54, Plate 9

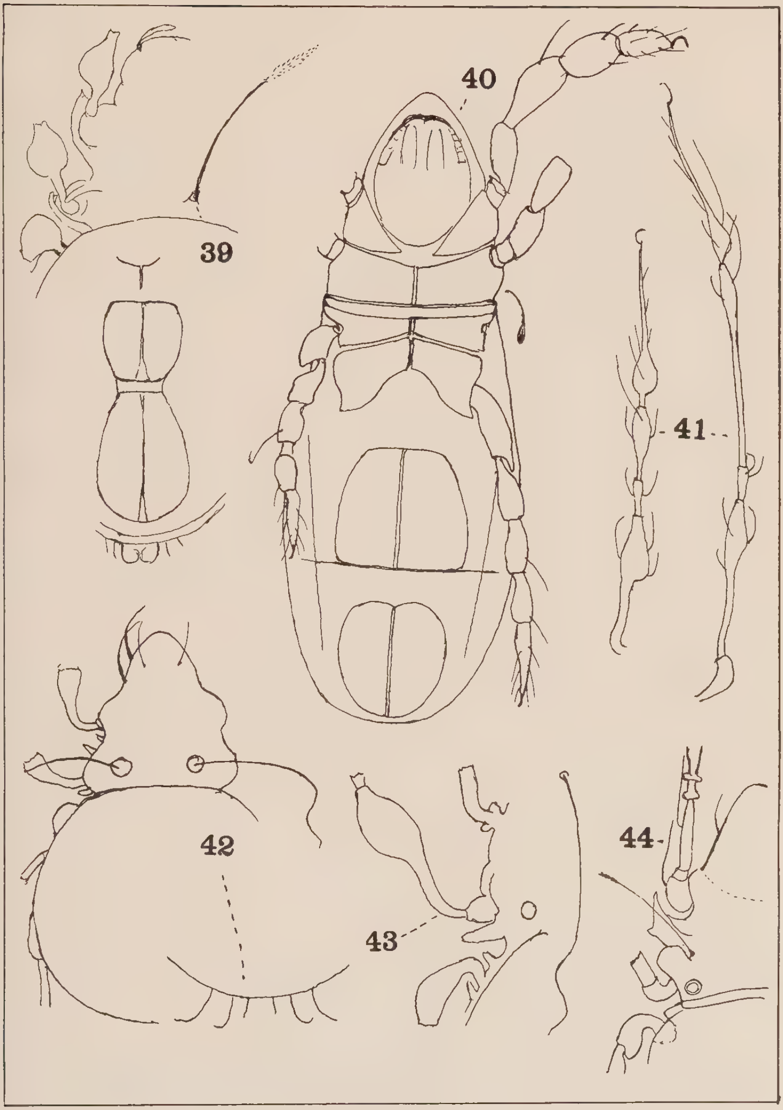


Banks—Acarina

PLATE 10

Fig. 39. *Gymnodamæus minor*, side of cephalothorax, seta, and ventral apertures.
Fig. 40. *Epilohmannia elongata*, under side.
Fig. 41. *Oribata carolinensis*, first, and fourth legs.
Fig. 42. *Oribata carolinensis*, above.
Fig. 43. *Belba inæquipes*, side of cephalothorax, seta and tip of abdomen.
Fig. 44. *Allodamæus ewingi*, side of cephalothorax.

PSYCHE, 1947 VOL. 54, PLATE 10



BANKS—ACARINA

TRICHOPRIA TABANIVORA FOUTS IN MASSACHUSETTS (HYMENOPTERA, DIAPRIIDÆ)

By Norman S. Bailey
Biological Laboratories, Cambridge, Massachusetts

In the course of field investigations into the life history of the Saltmarsh Greenhead, *Tabanus nigrovittatus* Macquart, being carried out for the state of Massachusetts, two pupæ of that species were found. They were located in a pile of drift composed chiefly of coarse *Spartina* straw and the remains of other salt marsh plants that had accumulated on a ditch bank near the edge of the marsh. The pupæ were discovered on August 9, 1946, on the Pine Island Marsh in Newbury (Essex County). One was of the usual coloration, but the other was decidedly blackened and appeared unhealthy. Both were kept in small vials with a bit of the debris. A male horsefly emerged from the sound pupa and on August fourteenth a score of minute parasitic wasps came out of the second.

These were kindly determined for me by Mr. C. F. W. Muesebeck of the U.S.D.A. Bureau of Entomology and Plant Quarantine as *Trichopria tabanivora* Fouts of the Proctotrypid family Diapriidæ.

A subsequent search of the literature failed to reveal any record of the species since those originally reported by Cameron.[1] Segal repeated Cameron's record in his paper on the genus *Chrysops*.[2] Prof. Cameron raised 98 from a pupa of *Chrysops mitis* O.S. taken at Saskatoon and 112 from a pupa of *Tabanus reinwardtii* Weid. collected in Maple Creek, Saskatchewan. Fouts' description of the species was published with this data.[1]

This note indicates another Tabanid host species, a very different habitat, and a notable extension of range for the parasite. Furthermore, as far as the writer has been able to discover, these are the only known records of pupal parasites of Tabanidæ.

Six specimens of the series were sent to Mr. Muesebeck as the Bureau of Entomology collection contained only one paratype; twelve are in the Museum of Comparative Zoology.

---

[1] Cameron, A. E., Bull. Ent. Res., Vol. 17, Pt. 1, 1–42, 1926.

[2] Segal, Bernard, N. Y. Ent. Soc. Jour., Vol. 44, 51–78, 1936.

BOOK NOTICE

FLEAS OF WESTERN NORTH AMERICA. Their Relation to the Public Health; by Clarence Andresen Hubbard; pp. i–ix + 1–533, 5 half-tone plates, and many text figures. 1947. (The Iowa State College Press, Ames, Iowa. $6.00).

This companion volume to Irving Fox' "Fleas of Eastern United States," from the same Press (1940), far outstrips in scope any similar attempt in the field of the Siphonaptera. It is a handsome book, clearly printed and attractively bound.

The work opens with a history of the study of fleas in western North America, a feature to which entomologists are little accustomed. In a brief but competent discussion of fleas and disease it is stated that, since the introduction of bubonic plague in the United States in 1900, there have been 506 human cases, 321 of them fatal. It is to be feared, nevertheless, that the author's "Word of Warning" will fall upon deaf ears. Collecting ectoparasites is not a normal activity of the average entomologist. Hubbard describes in detail the special techniques involved in trapping the hosts, gathering the fleas, and mounting the specimens for study.

The chapter on the external anatomy of the flea is disappointing. For advanced students it could have been omitted altogether; while it is far too sketchy to meet the beginner's needs. Even some terms used in the main body of the book—such as pygidium, mesosternite and mesopleurite—are not explained.

The foregoing general topics cover a bare 40 pages, the bulk of the treatise being a detailed taxonomic study of 236 species and subspecies of Siphonaptera known to the author from North America west of the 100th Meridian. These he classifies in 5 families and 66 genera. Keys are provided for the identification of families and genera, and for the species and subspecies of most genera, with the exception of *Ceratophyllus* and *Megarthroglossus*. However, some of the keys to species are based on males only. Type locality and type host are given for nearly every form; but the present locatiôn of the types is omitted in most cases. The descriptions are clear and the many illustrations of details, comparing closely allied forms are most commendable.

Only 12 of the 302 fleas listed from America north of Mexico extend across the continent; and this number dwindles to 5 (one of them doubtfully in the East) after eliminating 7 species introduced from the Old World by man. The eastern flea fauna is, moreover, scanty, only 56 species and subspecies being known from east of the 100th Meridian, as against 236 from the western area. The explanation lies, of course, in the extremely poor mammalian fauna of the eastern area. The author has relied too exclusively on Irving Fox' book (1940) for his information on eastern fleas. H. S. Fuller in 1943 raised the number of species known from Vermont to 15 (not *one*, as stated by Hubbard), and recorded 9 species from West Virginia, from which state Hubbard says there are no published records.

In the careful and elaborate analysis of host relationships, the notes on the characteristics and behavior of the several types of hosts will be particularly useful. The relations between blood-sucking ectoparasites and their hosts are not merely those of taking and giving food. The parasite's structure, life-history and behavior are in most cases closely correlated with those of the host. The author's detailed information on the relative abundance of the several species of fleas often found on the same host may help to determine the normal or breeding, and the accidental or stray hosts of each species, leading eventually to the study of the factors determining the choice of the host.

The author is to be congratulated on his book, which crowns some fifteen years of field and laboratory work carried on with unusual enthusiasm.—J. Bequaert

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September, excepted) at 8:00 p.m. in Room B–455, Biological Laboratories, Divinity Ave., Cambridge. Entomologists visiting Boston are cordially invited to attend.

FOR SALE

The Librarian of the Museum of Comparative Zoology is offering for sale a limited number of sets of the "CONTRIBUTIONS FROM THE ENTOMOLOGICAL LABORATORY OF THE BUSSEY INSTITUTION." These are priced at $15.00 f.o.b., Cambridge, Massachusetts.

Each set includes reprints of 292 entomological papers which appeared in various entomological and zoological journals published during the period from 1909 to 1929. These form seven large volumes each substantially bound in red buckram, and a number of additional reprints to form an eighth volume. Altogether there are more than 5800 pages included. Shipping weight is approximately 50 pounds.

Orders should be addressed to Mrs. M. D. Frazier, Librarian, Museum of Comparative Zoology, Harvard University, Cambridge, Mass.

The Cambridge Entomological Club has for sale reprints of articles published in PSYCHE between 1910 and 1920. A list of articles available can be obtained from the Editorial Office of PSYCHE, Biological Laboratories, Divinity Ave., Cambridge, Mass.

BACK VOLUMES OF PSYCHE

The Cambridge Entomological Club is able to offer for sale the following volumes of Psyche. Those not mentioned are entirely out of print.

Volumes 2, 3, 4, 5, 6, 7, 8, 9, each covering a period of three years, $5.00 each.

Volumes 10, 12, 14, 17, each covering a single year, $1.00 each.

Volumes 18, 19, 20, 21, 22, 23, 24, 25, 26, each covering a single year, $1.50 each.

Volumes 27 to 53, each covering a single year, $2.00.

Orders for 2 or more volumes subject to a discount of 10%.

Orders for 10 or more volumes subject to a discount of 20%.

All orders should be addressed to

F. M. Carpenter, Associate Editor of Psyche,
Biological Laboratories,
Harvard University,
Cambridge, Mass.